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MARCH/APRIL 2015

SkyNews

The Canadian Magazine of Astronomy & Stargazing

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+

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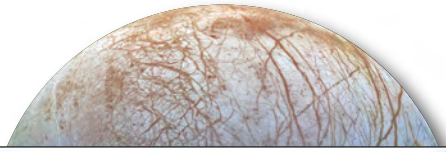

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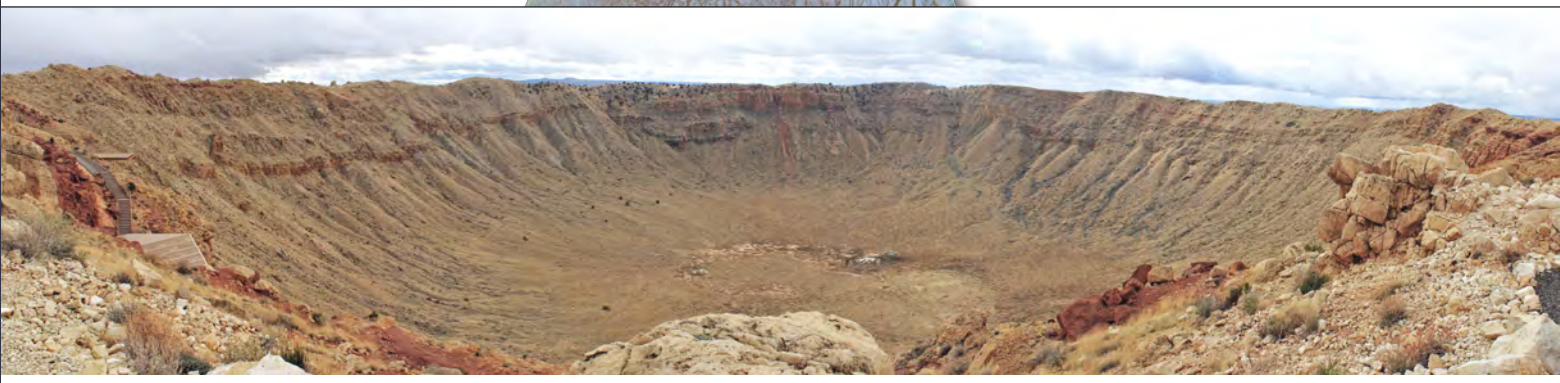
CONTENTS



13

COLUMNS

04 EDITOR'S REPORT TERENCE DICKINSON
Comet Brightens Winter Sky
Read about a comet that didn't fizzle and about the upcoming exploration of Pluto and beyond

16 ON THE MOON GARY SERONIK
Lunar Opposites
The Moon's phases reveal subtle and surprising insights into the solar system's clockwork motions

18 WILDERNESS ASTRONOMER PETER McMAHON
Irving Nature Park
Saint John's urban star park is New Brunswick's ultimate 'backyard astronomy' destination

44 OTHER WORLDS IVAN SEMENIUK
Doubling Down on Dark Matter
A second generation of experiments is opening new windows on the search for dark matter

46 NORTHERN NIGHTS KEN HEWITT-WHITE
Hitchhiker's Guide to a Comet
Late March 1970: Comet Bennett was entering our Canadian sky. I simply had to observe it, but that meant getting to a place in the sticks called the Quiet Site.

DEPARTMENTS

08 LETTERS

10 NEWS
Construction Begins on World's Largest Telescope; Small Asteroid Impacts Mapped; Comets: Main Source of Earth's Water?

20 THE BIG PICTURE
Best Europa View Ever

22 SCOPING THE SKY KEN HEWITT-WHITE
Beauty and the Beast
Strikingly unalike, the galaxies Messier 81 and Messier 82 form the most alluring galaxy pair in the heavens

24 STAR CHART
Night Sky for Early Spring for Canada and the Northern United States

38 THE BIG PICTURE
Milky Way on the Rocks

41 CONSTELLATION CORNER KEN HEWITT-WHITE
Leo
One of the most prominent constellations in the zodiac

FEATURES

14 GALLERY
BEAUTIFUL UNIVERSE
Some of these reader images required a serious investment in equipment; others were captured with a DSLR camera on a tripod

26 EXPLORING THE NIGHT SKY BY ALAN DYER
LUNAR ECLIPSE AT EASTER
A total lunar eclipse darkens the full Moon for western North America on Easter weekend. Venus climbs high into the west to shine in the evening sky for the first time since 2013.

26

38

COVER: On December 20 at 1:30 a.m., Calgary photographer Brett Abernethy saw this brilliant bolide meteor light up the night while he was taking a time exposure of a winter scene in Banff National Park. Abernethy instantly knew that he had the shot of a lifetime. For details, see his letter on page 8.

by Terence Dickinson

Comet Brightens Winter Sky

Read about a comet that didn't fizzle and about the upcoming exploration of Pluto and beyond

AUSTRALIAN AMATEUR ASTRONOMER and comet hunter Terry Lovejoy found his latest comet just before dawn on August 17, 2014, on CCD camera images taken with his 8-inch telescope. It's the fifth comet he has discovered since 2007. Officially known as C/2014 Q2, Comet Lovejoy was magnitude 15 at discovery, exceptionally faint to have been picked up with such a modest telescope. Our website editor Gary Seronik has been providing easy-to-use charts and data over the past few months as Comet Lovejoy has moved across the winter sky below Orion and up past the Pleiades star cluster. At magnitude 4, the comet's blue-green head was an easy binocular object in January. Its slender tail, so prominent in Alan Dyer's photo at left, was a faint wisp visually in binoculars but impressive in time exposures. Check Gary's reports at www.skynews.ca to see where the comet is tonight. On January 30, it was at perihelion (its closest point to the Sun). It was closest to Earth on January 7.

NEW COMET LOVEJOY Discovered by Australian amateur astronomer Terry Lovejoy (his fifth comet), this celestial visitor became an easy binocular object in January for northern-hemisphere observers. PHOTO BY ALAN DYER

Comet Lovejoy is a very long-period comet. The comet's path on the way in to the inner solar system at this return indicated an orbital period of roughly 11,500 years. But gravitational perturbations from Jupiter and, to a lesser extent, the other planets in the solar system have altered the comet's orbit a bit. Its next return is projected for about 8,000 years from now.

An information technology specialist by day, Terry Lovejoy has been searching the night skies since 2004. "It takes time and patience," he says, "but then finally something appears, and it is just amazing." His astronomical camera takes 1,000 images overnight that are then examined by computer to select slow-moving objects —comets and asteroids. At first, he thought his latest find was an asteroid.

"I thought it was a known asteroid to start with. It didn't have a tail that I could see, so it didn't look like a comet." The following night, he took photographs at a higher resolution. "I could see the tiny bit of tail and the coma, or head, which was small, but you could definitely see it. I was pretty sure I had something new." It took just three days for the global authority, the International Astronomical Union's Minor Planet Center, in Cambridge, Massachu-

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setts, to confirm that the object was, indeed, a new comet.

PLUTO, THE KUIPER BELT, THE OORT CLOUD AND—AS ALWAYS—PLANET X

At lunch with two of my astronomy friends recently, our waiter saw an issue of *SkyNews* on the table and asked, "Have they found Planet X yet?"

There are very few aspects of astronomy that virtually everyone has heard about at one time or another. Two of them—the canals of Mars and Planet X—originated more than a century ago with Boston polymath Percival Lowell, who became obsessed with both. Lowell Observatory, in Flagstaff, Arizona, was founded, in part, to study the canals and to search for Planet X, a hypothesized planet beyond Neptune, perhaps as large as Earth, orbiting our Sun but concealed by distance and darkness.

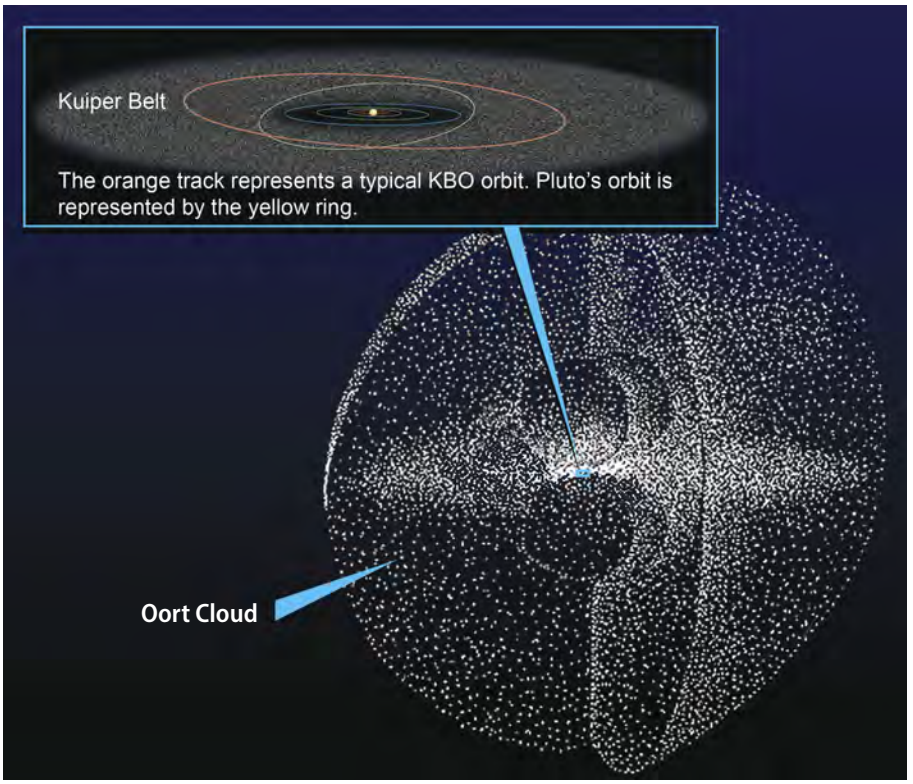
The exploration of Mars by spacecraft over the past half century has conclusively nailed the lid shut on the existence of any Martian canals as artifacts of intelligent life on our neighbour world. But Planet X has never gone away. Every so often, a few astronomical loose ends are said to point to the existence of an undiscovered body way out there.

The attraction of the Planet X idea is that Neptune's existence was predicted in the middle of the 19th century by studying the gravitational perturbations on Uranus by the then unknown Neptune. Presumably, the same technique would uncover the next planet.

Although the discovery of Neptune was a triumph of mathematics, Pluto's discovery was serendipitous—the result of the meticulous work of Clyde Tombaugh, a young astronomer hired to search for Lowell's Planet X. Pluto turned out to be far too small to cause any measurable effects on other planets.

Regardless, dozens of scientific papers have been published suggesting that there is evidence to support the existence of planets of various masses, orbits and distances. Searches have been made for a few of them, but not one has been found, and no planetary body as large as or larger than Earth may actually exist.

However, more than 1,000 bodies the size of Pluto and smaller have been discovered in the Kuiper belt, the icy debris field past Neptune. These are known as Kuiper belt objects (KBOs). The belt extends from the orbit of Neptune, at 30 times the Earth's distance from the Sun (30 astronomical units, or 30 AU), to roughly 50 AU. It is structurally similar to the asteroid belt but vastly larger and about 100 times as massive. Like the asteroid belt, the Kuiper belt consists mainly of remnants from the formation of the solar system.



THE VAST UNKNOWN Millions of small frozen worlds may reside in the Kuiper belt and the Oort cloud. Our exploration of these regions is just beginning. Since the discovery of the first Kuiper belt object, in 1992, about 1,000 have been identified. After the New Horizons spacecraft reaches Pluto in July, it will be targeted to fly past a Kuiper belt object around 2018. NASA ILLUSTRATION

Although asteroids are composed primarily of rock and metal, most KBOs are frozen methane, ammonia and water. The Kuiper belt is home to at least three dwarf planets: Pluto, Haumea and Makemake. Some of the solar system's moons, such as Neptune's Triton and Saturn's Phoebe, are believed to have originated in this region.

The Kuiper belt should not be confused with the Oort cloud, which is a thousand times more distant, as suggested by the illustration on this page.

KUIPER BELT CLUES

A significant find in the ongoing search for objects beyond Neptune and Pluto was the discovery of a 450-kilometre-wide dwarf planet just beyond the Kuiper belt. Designated 2012 VP113, it has an orbit that loops around the Sun in a vastly elongated path carrying it from a minimum distance of 80 AU to a maximum distance of 445 AU. Although 2012 VP113 seems similar in composition to KBOs, it shares its odd trajectory outside the belt with only one other known object: Sedna, another dwarf planet, discovered in 2003. But astronomers say that these two objects shouldn't be out there. Something had to have dragged the dwarf planets from their original smaller orbits. Except nothing is massive enough to take the credit—at least, nothing of which astronomers are aware.

The culprit may be a Planet X—perhaps another Pluto that was somehow flung out there. The enormous stretched orbits of Sedna and 2012 VP113 are unlike anything else in the solar system. Both are too far from Neptune to feel that planet's effects. Their trajectories could be a relic of a passing star or the changing influence of the Milky Way's gravity as the Sun moves around the galaxy or of a massive planet, long gone or yet to be detected.

What could be out there that existing satellites or Earth-based telescopes would not have detected yet? A planet the same mass as Earth at about 250 AU would do it. But some researchers say it would take a body at least twice that massive.

The ongoing speculation about additional "far-out" planets has a familiar ring, says David Jewitt, a Kuiper belt expert at UCLA. In the late 1800s and early 1900s, he says, astronomers relied on apparent deviations in Neptune's motion and a handful of comets to kick off a search that eventually led to the discovery of Pluto. But it was incomplete data, and Pluto was too small in any case.

Over the next half century, the search for more planets went in and out of vogue. When one theory was shot down, new predictions emerged like weeds. NASA's Voyager 2 spacecraft settled the Planet X question—for a time. When the probe flew past Uranus and Neptune in the 1980s, it gave astronomers better data with which to revise the masses of these two big planets. The new data revealed that nothing unaccounted for was pulling on them.

"But," says Jewitt, "we would not yet have detected an Earth 600 AU from the Sun." And that's assuming researchers knew where to look. "That gives you an idea of the darkness of the outer solar system."

Instead of trying to observe a planet directly, researchers are looking for more KBOs whose orbits might bear the gravitational signature of something unseen.

A new superhero may be the Large Synoptic Survey Telescope (LSST), an 8.4-metre telescope that is under construction in northern Chile, with completion planned for 2022. Unlike other giant telescopes, the LSST will have an enormous field of view and will make a complete survey of the sky to 24th magnitude *every week*.

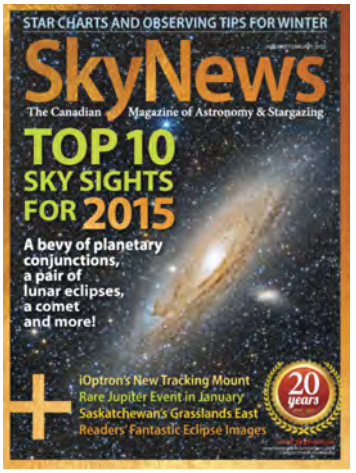
The LSST could find 20,000 to 40,000 more bodies in the Kuiper belt, vastly increasing the known total by a factor of at least 20—enough KBOs to see whether there are more objects with bizarre orbits. Equally important, as part of its normal research program, the LSST could detect an Earth-sized planet out to about 400 AU.

How would an Earth-sized planet get out there? A close encounter with either Uranus or Neptune in the early history of the solar system could slingshot an Earth-sized ball of rock to well beyond the Kuiper belt. A Planet X might also be an escapee from another solar system. In the early days of our solar system, newly formed suns were probably closer together. A planet could have been torn away from one star and captured by the gravity of another. A close encounter with a passing star could have pulled Sedna and 2012 VP113 away from their siblings. However, stellar flybys are rare, but the odds go up if the star is born in the same nebula as the Sun.

For nearly two centuries, the lure of planets hiding beyond Neptune has never faded. The remoteness of the outer solar system, says Jewitt, "leaves open the door to all sorts of wild speculation."

A COMMENT ABOUT THE *SKYNEWS* JAN./FEB. COVER

I may have misled readers who admired the superb Andromeda Galaxy cover image by Lynn Hilborn on our last issue. Lynn did, indeed, take the picture, but not with his 140mm refractor, as I stated in the cover caption on page 3 of that issue. I flubbed it. The reality is more impressive.



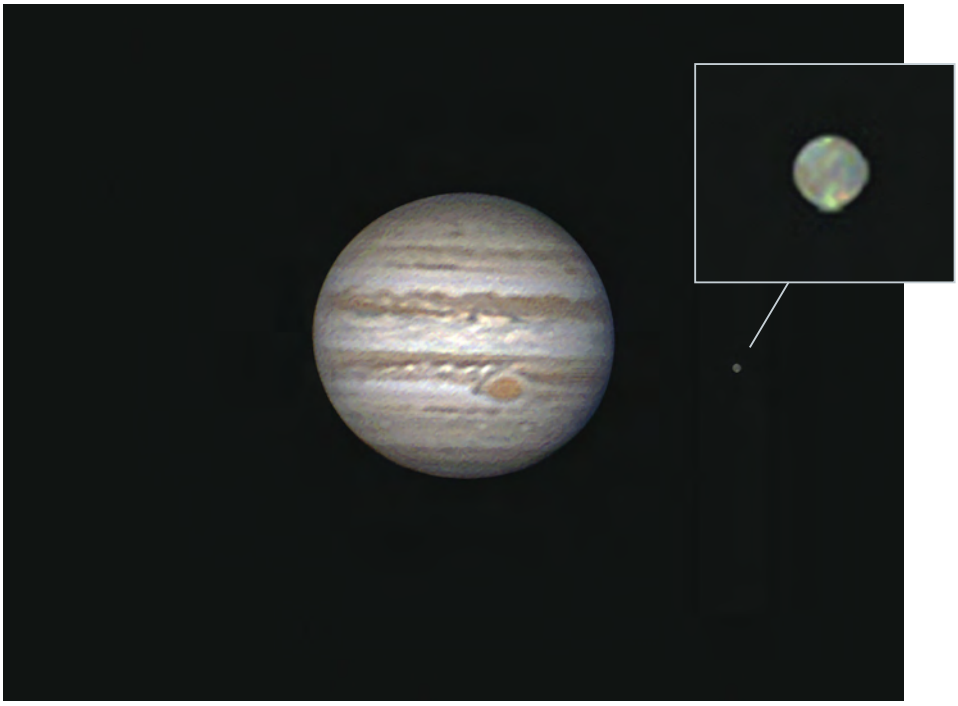
Lynn Hilborn's Andromeda Galaxy on the cover of the January/February 2015 *SkyNews*

Using an optic only a fraction of the refractor's size and bulk—an off-the-shelf Canon 200mm f/2.8 camera lens about the size of a Pringles tube and weighing less than two pounds—Lynn attached it to his Finger Lakes Instrumentation CCD camera. After several nights, he had accumulated 8.5 hours of exposures through various filters. More hours of computer processing later, and voila! A cover photo that looks as if it was taken by the Palomar Schmidt camera.

Lynn is one of a handful of Canadian master astro-imagers who regularly contribute their work to *SkyNews* for our readers' enjoyment. And we know from your e-mails that you do appreciate it. ✦

Editor Terence Dickinson invites your comments and astronomy-related observations and photos, which can be directed to him at dickinsonSkyNews@gmail.com.

LETTERS



WONDERFUL JUPITER

In excellent seeing a few minutes after midnight on December 29/30, I captured Jupiter and its second largest moon Callisto from my home in a suburb of Montreal. Some detail can be seen on Callisto just at the limit of detection (inset). I used my Sky-Watcher 8-inch Newtonian telescope, a 4x Barlow and a DBK 21AU618.AS CCD camera with a Baader UV/IR cut filter.

Daniel Leclerc
Montreal

EDITOR'S NOTE: *For the inset image of Callisto,* SkyNews *enhanced and enlarged Leclerc's original photo. It suggests surface features but could be processing artifacts. Callisto's apparent diameter is 1.6 arc seconds, and the resolving power of an 8-inch telescope is 0.5 arc second.*

SHOT OF A LIFETIME

For years, I have specialized in night photography in the Calgary area, including the Rocky Mountains. On the night of December 19/20, I coordinated a trip to Banff National Park with another night photographer to capture a forecast aurora in a mountainous landscape setting.

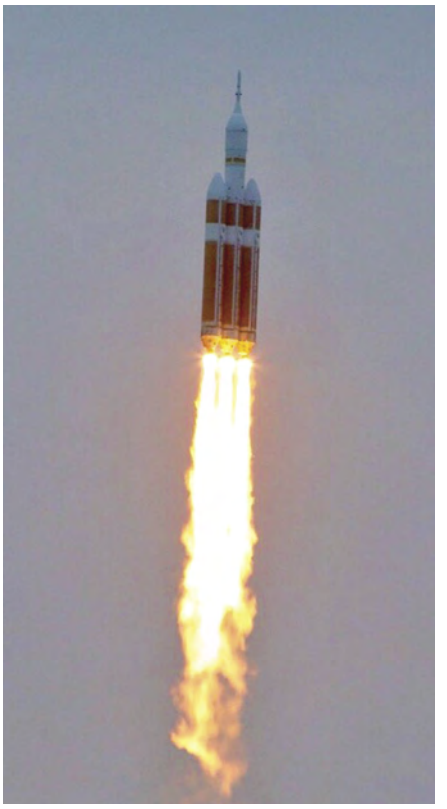
Once on location, we saw that there was a lot of cloud in the northern sky, so I decided to shoot to the south to photograph Mount Rundle, the stars, some clouds and the snowy foreground. While taking my second exposure, which is reproduced on the cover of this issue, a fireball meteor streaked through the composition. For a second or two, everything was lit up like daylight. The fireball broke up into at least three pieces and turned bright orange before fading away.

After the shock and awe of what we had just seen wore off, I realized that I had been taking an exposure of 40 seconds or more. Excitement quickly turned into concern that the shot might be overexposed or totally blown out or that the fireball would be completely out of frame. A quick check confirmed that the entire meteor streak had been captured, from entry point to where it faded away. Right then, I knew this was a shot of a lifetime. (Photo details: Canon 5D Mark III, 21mm 2.8 lens at f/4, 49 seconds at ISO 3200.)

Brett Abernethy
Calgary

SUBMITTING LETTERS AND PHOTOS

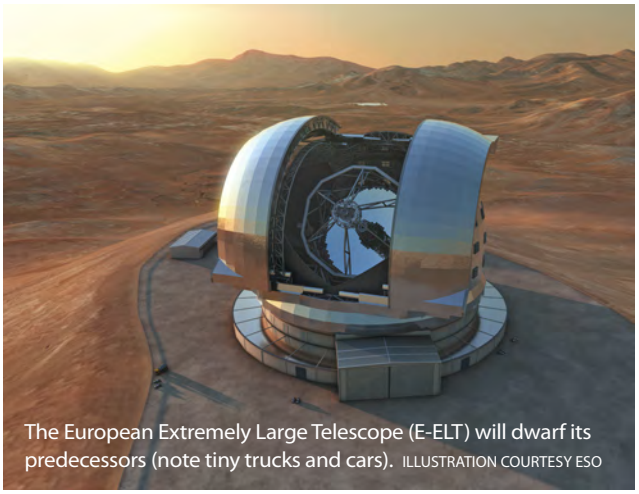
SkyNews *editor Terence Dickinson welcomes your letters about your astronomical observing activities and about anything you read in the magazine. Submission of photos as attachments is encouraged. Send photos in jpeg format to dickinsonSkyNews@gmail.com.*



IMPRESSIVE LAUNCH

On December 5, 2014, at 7:05 a.m., EST, NASA launched its next-generation spacecraft Orion for a 4.5-hour test flight. Orion is designed to carry a crew of up to six, but for this flight, it was filled with test equipment rather than astronauts. Future versions will be launched with a bigger rocket than the already huge Delta IV Heavy. The weather for the launch at Cape Canaveral, Florida, had high cloud and a moderate wind. While the low, flat light at sunrise (due to the clouds) and the brilliant rocket flame helped to produce dramatic launch images, they also made this a very difficult scene to photograph. The main image was taken with a remote Canon camera triggered by a sound sensor. The Delta IV Heavy is one of my favourite launch vehicles to observe, as it starts very slowly and then the sound hits you. You can feel the ground shaking and your chest cavity reverberating as the powerful sound energy spreads across the whole coastal area. The smaller image was shot with a Canon 6D and a 400mm lens. It is hard to believe that it has been 39 years since a human-rated spacecraft was recovered from a splashdown. (I am really starting to feel old!)

Don Hladiuk
Calgary



The European Extremely Large Telescope (E-ELT) will dwarf its predecessors (note tiny trucks and cars). ILLUSTRATION COURTESY ESO

CONSTRUCTION BEGINS ON WORLD'S LARGEST TELESCOPE

Monumental project with 39-metre-diameter main mirror is scheduled for completion by 2022, and research will be under way by 2025

ALREADY GRADED in preparation for construction, the summit of a 10,000-foot Chilean mountain known as Cerro Armazones will be home to the European Extremely Large Telescope (E-ELT)—the largest optical instrument in the world. The gargantuan telescope will give astronomers the capability of studying the atmospheres of planets of other stars and examining galaxies up to 13 billion light-years distant. The E-ELT will be built by a consortium of 13 European nations plus Brazil. Its 39-metre-diameter mirror will be constructed of 798 precision hexagonal sections that will act as a single huge mirror, a system similar to that on the two 10-metre Keck telescopes on the island of Hawaii.

Funding for the major components—the giant domed building, the telescope and associated infrastructure—was approved last December, and construction is now under way. The schedule calls for completion of the main building and telescope, as shown in the illustration above, by 2022. Testing of the electronics and camera along with accessory instrumentation should be completed by 2024, with astronomical research set to begin by 2025.

SMALL ASTEROID IMPACTS MAPPED

Research provides clues about the solar system's asteroid population

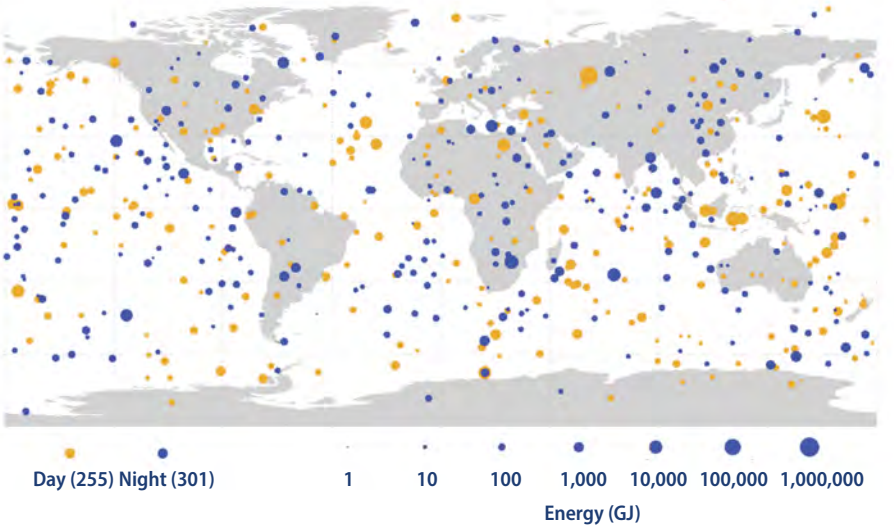
SMALL ASTEROIDS roughly a metre in diameter hit the Earth's atmosphere and disintegrate with surprising frequency—averaging once every two weeks. Data gathered by U.S. military and other government sensors and released to NASA for use by the science community reveal that these small impact events are both frequent and random. A NASA map (below) of these impact events, known to astronomers as fireballs or bolides, shows the frequency and the approximate energy released by bolide events detected from 1994 through 2013. Over this period, 556 bolide events of various energies were recorded.

On this NASA map, the size of the orange dots (daytime events) and blue dots (nighttime events) are proportional to the optical radiated energy of the impact event. The smallest dot on the map represents one billion joules, or one gigajoule (GJ), of optical radiated energy. When expressed in terms of total impact energy, this is equivalent to about five tons of TNT explosives. The dots representing 100, 10,000 and 1,000,000 GJ of optical radiated energy correspond to an impact energy of about 300 tons, 18,000 tons and one million tons of TNT explosives, respectively.

The largest impact energy recorded on the map is the daytime Chelyabinsk event (440,000 to 500,000 tons of TNT explosives) that occurred over central Russia on February 15, 2013. Before the small asteroid encountered Earth, breaking up and exploding in the atmosphere, it was about 20 metres in size. The detonation was 30 times the brightness of the Sun. While that impact focused public attention on the potential hazards of asteroid impacts with Earth, space scientists know that such events are inevitable.

Bolide Events 1994-2013

(SMALL ASTEROIDS THAT DISINTEGRATED IN EARTH'S ATMOSPHERE



NASA's Near-Earth Object (NEO) Observations Program finds, tracks and characterizes asteroids whose orbits bring them within about 50 million kilometres of the Earth's orbit around the Sun.

"The Earth's atmosphere does a great job of protecting our planet from small asteroids," says NEO Observations Program executive Lindley Johnson. More than 96 percent of the estimated population of nearly 1,000 one-kilometre or larger asteroids have already been identified through this program. The current objective of the program is to identify 90 percent of the NEOs larger than 140 metres in diameter. These asteroids may be as much as 25 times more numerous than the one-kilometre asteroids.

Every day, Earth is bombarded with more than 100 tons of dust- and sand-sized particles from space. About once a year, an automobile-sized asteroid plunges into the Earth's atmosphere, creating a spectacular fireball (bolide) event as the friction of the atmosphere causes the asteroid to disintegrate—sometimes explosively.

Studies of the Earth's history indicate that approximately once every 5,000 years or so, on average, an object the size of a football field impacts our planet and causes significant damage. Once every few million years, an object large enough to cause regional or global disaster hits Earth. Impact craters on Earth, the Moon and other planetary bodies are evidence of these occurrences.

In a 2013 paper published in *Nature*, Canadian planetary scientist Peter Brown and his colleagues reported that "telescopic surveys have only discovered about 500 near-Earth asteroids that are 10 to 20 metres in diameter (comparable to the Chelyabinsk asteroid) of an estimated near-Earth asteroid population of around 20 million, implying that a significant impacter population at these sizes could be present but not yet catalogued."

ASTEROID IMPACT Meteor Crater, located near Winslow, Arizona, is stark evidence of a metal-rich 50-metre asteroid clobbering Earth about 50,000 years ago. The impact released the energy equivalent of a 10-megaton explosion and formed a 1.2-kilometre-wide crater. Scientists have identified several dozen impact craters in North America, most masked by thousands of centuries of erosion and vegetation. PHOTO BY GORD RIFE

COMETS: MAIN SOURCE OF EARTH'S WATER?

European Space Agency's Rosetta spacecraft examines the peanut-shaped nucleus of a comet

WHERE DID OUR PLANET GET ITS OCEANS? This is one of the most perplexing scientific questions about the origins of Earth. The leading theory holds that water was brought to Earth by the ancient impacts of comets and asteroids. However, data from the European Space Agency's Rosetta spacecraft indicate that terrestrial water did not come from comets—at least not from comets like 67P/Churyumov-Gerasimenko, which Rosetta is now orbiting. Researchers agree that water must have been delivered to Earth by impacts of small bodies. Was it asteroids from the region of Jupiter, comets that formed inside Neptune's orbit or comets that formed outside Neptune's orbit? The key to determining where the water originated is in its level of deuterium, a heavier form of hydrogen. By comparing the ratio of deuterium to hydrogen (D/H) in different objects, scientists can identify where in the solar system a particular object originated. And by comparing the D/H ratio in the Earth's oceans with that in other bodies, scientists can identify the origin of our water. In December, Rosetta instruments found that the D/H ratio in water vapour venting from the nucleus of Comet 67P/Churyumov-Gerasimenko is more than three times the terrestrial value. Based on this and other spacecraft findings, it would appear that asteroids, not comets, are the source of the Earth's water.

COMET CLOSE-UP Comet 67P/Churyumov-Gerasimenko is a 4.3-kilometre-long battered clod of dust and water ice. PHOTO COURTESY ESA

BEAUTIFUL UNIVERSE

These images were recently received from our readers. Some of the night shots required a serious investment in equipment; others were captured with a DSLR camera on a tripod.

LATE-AUTUMN STAR TRAILS Waiting for an aurora that never materialized one evening late last fall when moonlight washed the landscape, Matthew Barton of Sudbury, Ontario, decided to capture a star-trail scene by taking 305 short exposures with a Canon 7D fitted with a 14mm f/3.5 lens. When the hundreds of images were later digitally stacked, roughly an hour's worth of star trails adorned the view.

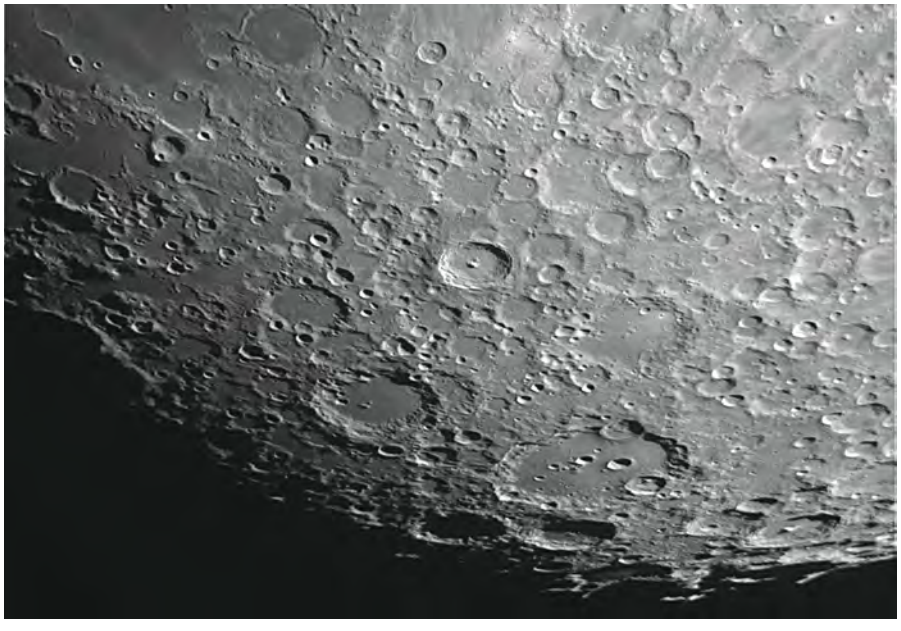
EMISSION NEBULA CED 214, IN CEPHEUS, is a star-forming region about 3,000 light-years away inside the Milky Way. Ced 214 is embedded in the open cluster Berkeley 59, which is causing the nebula to glow. Astro-imager Ron Brecher used an SBIG STL-11000M CCD camera and Baader LRGB filters on his 10–inch f/3.6 ASA Astrograph reflector to take this10-hour exposure from his observatory in Guelph, Ontario. (For more information about this image, go to www.astrodoc.ca.)

◄ **COCOON NEBULA** Resembling an autumn leaf floating in a starry abyss, the Cocoon Nebula adorns the Milky Way in the constellation Cygnus, at a distance of 4,000 light-years from Earth. Astro-imager Howard Trottier captured the exquisite beauty of the ¼-degree-wide star-forming cloud in this 10-hour CCD exposure with LRGB filters. He reports: "My equipment is a PlaneWave CDK 17-inch reflector on a Paramount ME mount, with an Apogee U16M camera and filter-wheel combination, Astrodon filters and an Astrodon MOAG with a Starlight Xpress Lodestar for the guide camera." Trottier's observatory is located in the southern Okanagan region of British Columbia.

◄ **M101, PINWHEEL GALAXY** At a distance of 25 million light-years, the Pinwheel is relatively close to our Milky Way Galaxy and is faintly visible in 50mm or larger binoculars near the star Mizar, in the Big Dipper. This impressive portrait was obtained by Brian McGaffney from his observatory just south of Bancroft, Ontario. About 170,000 light-years across, M101 is larger than our home galaxy, which is 90,000 light-years in diameter. M101 is an asymmetrical galaxy, its spiral arms being gravitationally disturbed by neighbouring galaxies. This image was taken over five nights through a 17-inch reflector.

▼ **CLAVIUS AND A WELTER OF CRATERS** Using an Orion 8-inch f/4 Newtonian reflector with a QHY5L-IIM CCD camera, Halifax astro-imager Jeff Donaldson recorded this sharp view of the southern cratered region of the Moon. Clavius is the large crater at bottom. The distinct but smaller crater close to the exact centre of the image is Tycho. Of the 1,525 short exposures taken, 1,000 of the best were digitally stacked to create the striking final image.

▲ **VENUS-JUPITER CONJUNCTION** Passing within a quarter of a degree of each other on the morning of August 18, 2014, the bright planets Venus (left) and Jupiter presented one of the most spectacular conjunctions of recent years. Kevin Watson observed the event from his backyard in Oakville, Ontario, recording this scene through a 6-inch f/5 Newtonian.



by Gary Seronik

Lunar Opposites

The Moon's phases reveal subtle and surprising insights into the solar system's clockwork motions

I SPEND A LOT OF TIME glued to the eyepiece of my telescope exploring the lunar surface. There are few things I enjoy more than cranking up the magnification on a night of steady seeing and watching as the first rays of sunlight creep across the floor of a crater or catch the tip of a lunar mountain just emerging from shadow. Sweeping up and down the terminator is a fine way to spend an evening. But I also find great reward in the "big picture" perspective too, observing the Moon night after night as it wanders along the ecliptic going through its cycle of phases. And for that, I don't need any equipment. Best of all, it can lead to some fascinating insights.

While it's highly unlikely that I'll ever visit our nearest neighbour in person, I can imagine my view of Earth from the surface of the Moon. For one thing, thanks to the same orbital dynamics which ensure that one side of the lunar globe always faces Earth, our planet would remain relatively stationary in the lunar sky. The Earth's bright mottled disc never rises or sets; it simply remains parked in roughly the same area of the sky, hour after hour and night after night. Indeed, a telescope in a lunar observatory wouldn't need a tracking mount for Earth-gazing sessions. Yet although our home planet remains stationary, it does go through the same cycle of phases the Moon does, but with a twist:

DECEIVINGLY BRIGHT The full Moon always lies opposite the Sun's position in our sky, so it rises as the Sun sets and sets as the Sun rises. Similarly, the winter full Moon rides high in the sky while the Sun traces a shallow arc low in the south. PHOTO BY GARY SERONIK

The Earth's phase is always the inverse of the Moon's phase. For instance, when we see a crescent Moon, an astronaut on the lunar surface would see a fat gibbous Earth. And when we're enjoying a full Moon, our lunar observer would experience a "new" Earth.

A different, more down-to-Earth perspective arises from observing the full Moon. If you watch the lunar comings and goings with regularity, you already know that the full Moon lies opposite the Sun's position in the sky. So when the full Moon is rising, the Sun is setting, and vice versa.

The two bodies are positioned opposite each other on the ecliptic. When the full Moon lies in Gemini, the Sun is residing in Sagittarius. One unexpected manifestation of this alignment came to my attention when I was a child.

I remember getting up late one night in December and making my way downstairs to the kitchen in search of a midnight snack. When I looked out the kitchen window, I could see our yard in impressive detail, brightly illuminated by a full Moon. Unexpectedly, I was struck with the strange sensation that it was summer outside. Of course, even half asleep, I knew it wasn't, but there was something about the appearance of the yard that brought to mind a lazy summer day. I almost expected that if I were to step outside, I'd be greeted with warm temperatures and the scent of blooming flowers from my mum's garden. The sensation was as odd as it was powerful, and I couldn't shake it. Years later, it finally dawned on me how a cold December night could seem like July.

Because the December full Moon is situated in the same position that the Sun lies in July, the trees in my yard at midnight had the same stubby shadows they have at midday during the summer. On some subconscious level, my brain registered this fact, allowing my imagination to wander to pleasant thoughts of warm summer days. Perhaps there really is magic in the moonlight! ✦

Gary Seronik is the editor of this magazine's website, SkyNews.ca, and an expert lunar observer.

by Peter McMahon

Irving Nature Park

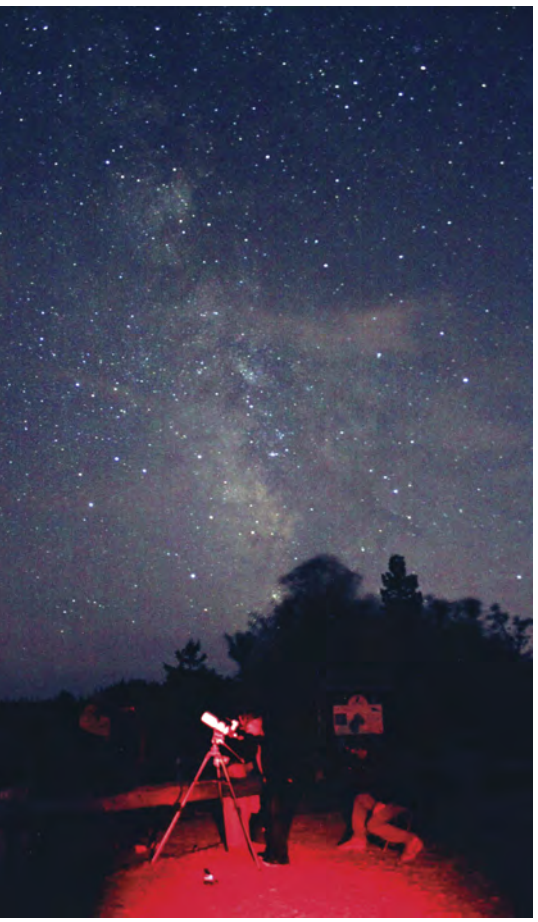
Saint John's urban star park is New Brunswick's ultimate 'backyard astronomy' destination

IMAGINE HAVING YOUR OWN PERSONAL backyard stargazing site with daytime views of incredible flora and fauna, flat horizons for evening viewing and a natural barrier against stray light from the glare of civilization.

If you're one of the 100,000 or so people who live in Saint John, New Brunswick, you're in luck. Such a place exists within minutes of your home. (If you don't live in Saint John, you can still enjoy the novelty of having such a destination minutes from some of the finest dining and accommodations in the Maritimes.)

Irving Nature Park, on the western outskirts of Saint John, was designated as an urban star park (the "express" version of the more remote dark sky preserve) in 2011 by The Royal Astronomical Society of Canada (RASC).

Just 20 minutes from downtown, this 600-acre publicly accessible oasis of forest, marshland and sprawling beaches is owned and operated by J.D. Irving, Limited and is open to vehicle traffic from May to October. While the skies over this highly convenient stargazing site aren't the darkest on the East Coast, they're far enough from the city that a slight rise in terrain, which anyone east of Calgary would call a hill, blocks the brunt of direct light pollution from Saint John, affording views of the southern Milky Way as good as you're likely to see so close to a major urban centre.



Getting to Irving Nature Park is easy. A mere 10 kilometres from downtown Saint John, take the exit off the Trans-Canada Highway at Sand Cove Road. Within the park, there are many nooks and crannies worth exploring day and night. Hike along a walking trail through primordial forests, or enjoy bird watching on the boardwalk that extends into the park's salt marsh. From the seal-observation deck, you can watch harbour seals diving for food or basking on the rocks in the warm sun.

The best night-sky views are facing south onto the Atlantic, along the park's 11 kilometres of ocean shoreline. But perhaps the coolest place to go stargazing is atop the wooden Lookout Tower, which rises out of the trees on the park's highest point—bring your binoculars. Park naturalists offer free guided tours and interpretation of local flora, fauna and geology (check out the nearby acclaimed Stonehammer Geopark).

WHERE TO STAY

Here, unlike other dark sky parks, you're only five minutes from the city limits or 20 minutes from downtown. Heck, during my time in the park, I stayed at the Hilton (a deal at about $120 a night). This is the only dark sky park in North America where you have your choice of virtually every accommodation brand found in all major cities.

WHERE TO EAT

Take your pick! As with accommodation, dining near this urban star park is vastly more civilized than it is at darker sites in the more remote regions of the province. Good cheap eats near the park include the clams, burgers and other tasty fare at Bob's Corner Take-Out or a yummy slice at Papa John's Pizza. But the best of the best in town comes from the award-winning East Coast Bistro and Urban Deli, both a little closer to downtown.

There are also picnic areas in the park, some of which have propane barbecues for visitor use. With a little planning, you can bring your own seafood or traditional BBQ eats, a few extra fixings and something to quench your thirst . . . all before a night of celestial delights not far from the backyards of the city. ✦

For a detailed guide to astronomy, science-minded attractions and amenities in Saint John, as well as notes on the other dark sky preserves in New Brunswick, go to WildernessAstronomy.com and click on the Magazine link.

EXTREME ASTRO-CONVENIENCE The southern sky and the summer Milky Way at Irving Nature Park are only a few minutes' drive from downtown Saint John, New Brunswick. PHOTO BY AUL OWEN

BEST EUROPA VIEW EVER

Jupiter's ice-encased moon has intrigued scientists for decades with hints of a subsurface ocean of water. Now a robotic mission to find out whether this is true is in the planning stages.

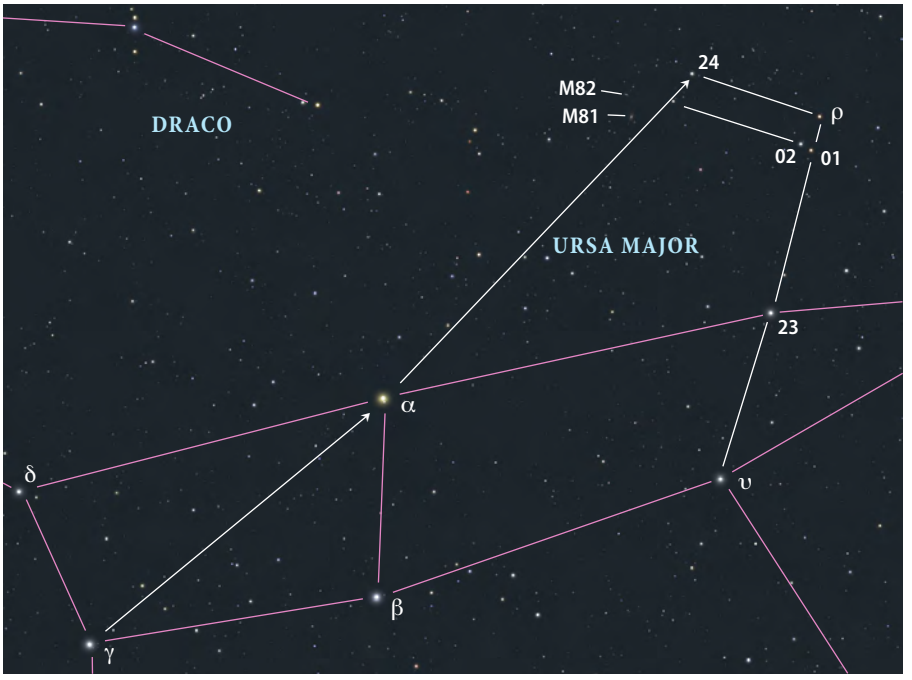
The puzzling, fascinating surface of Jupiter's icy moon Europa looms large in this newly reprocessed colour photo made using data gathered by NASA's Galileo spacecraft in the late 1990s. Carefully restored and geometrically corrected, this is a higher-resolution image of Europa than any yet released by NASA. A similar view was previously produced as a mosaic, with lower resolution and strongly enhanced colour. For this new version, the data were assembled into a colour image of the surface to approximate how Europa would appear to the human eye. This moon is like no other world in the solar system. Long, linear cracks and ridges crisscross Europa's surface, interrupted by regions of disrupted terrain where the surface ice crust has been broken up and has refrozen into new patterns. No mountains and only a few small craters exist on this unique world. Europa is approximately the size of the Earth's Moon.

COURTESY NASA/JPL

BEAUTY AND THE BEAST

Big, bright and strikingly unalike, the galaxies Messier 81 and Messier 82 form the most alluring galaxy pair in the heavens by Ken Hewitt-White

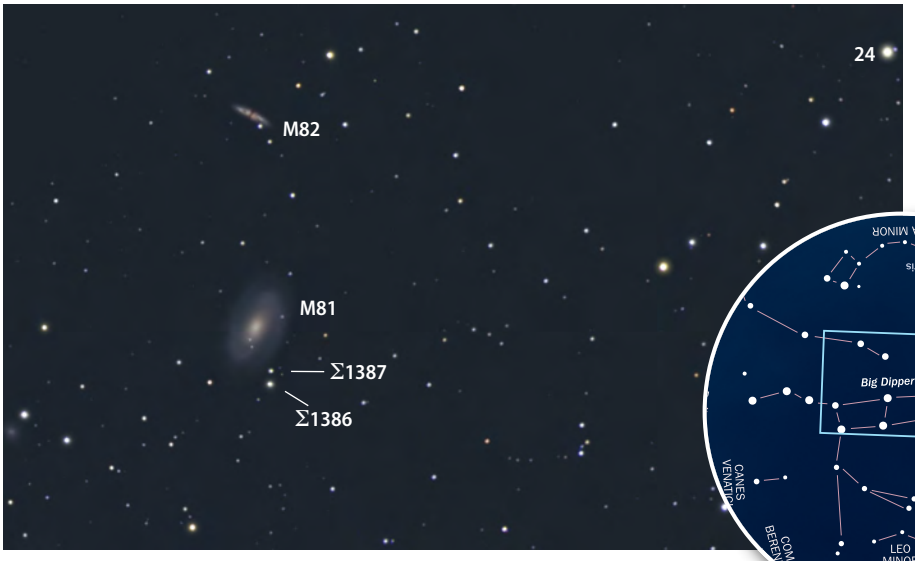
BARELY TWO-THIRDS OF A DEGREE APART in northernmost Ursa Major, the circumpolar galaxies **M81** and **M82** were discovered together by German astronomer Johann Bode in 1774. When French comet hunter Charles Messier observed the same objects several years later, he added them to his growing list of "false comets." Modern-day charts identify the galaxies by their well-known Messier numbers but sometimes also label them "Bode's Nebulae."



The pair is about 11 million light-years away, just outside our Local Group of galaxies. M81 is a face-on spiral galaxy sporting a large central bulge and two opposing spiral arms. M82 is an edge-on irregular galaxy whose highly distorted core is enveloped in jagged clouds of dust and gas. Astronomers think this anomalous structure was the by-product of an encounter between M81 and M82 that left the latter substantially altered. The result for us is an elegant spiral beside a disfigured wreck—a celestial Beauty and the Beast.

The Beauty (M81) shines at magnitude 6.9 and measures an impressive 27 by 14 arc minutes, the 2:1 oval oriented roughly north-south. The Beast (M82), 37 arc minutes to the north, is magnitude 8.4 and 11 by 4 arc minutes in extent, the 3:1 spindle oriented almost 90 degrees to its mate. The galaxies don't appear this large in backyard telescopes. M81, in particular, seems undersized because we detect mostly its bright central region. However, that massive middle is what makes M81 an easy catch every spring when it's high during evening hours.

On a moonless night last March, I observed the galaxies from my suburban yard



TWO GALAXIES IN ONE FIELD OF VIEW
In the entire night sky, no pair of galaxies is as bright and distinctive as M81 and M82. In a 6- or 8-inch telescope at low to medium magnification, they resemble the illustration at left. Use the upper illustration to find the galaxy duo in binoculars. Their location near the bowl of the Big Dipper makes M81 and M82 a showpiece target. Contemplate their distance of 11 million light-years. The light from M81 and M82 entering your telescope and then your eyes left the galaxies 12 million years ago.

CHARTS BY GLENN LEDREW

using my 10-inch Dobsonian reflector. My star-hop to the targets began at **gamma (γ) Ursae Majoris**, in the bowl of the Big Dipper. From gamma, I gazed diagonally across the bowl to **alpha (α) Ursae Majoris**, then veered slightly northward off that sight line a similar distance to the 4.5-magnitude star **24 Ursae Majoris**. That marker, plus a 5.7-magnitude star nearly one degree to the southeast, showed in my 8x50 finderscope. Exactly one degree east of the dimmer star, the finder swept up a minuscule glow: the luminous heart of M81. In the main telescope at 47x, the glow became an eight-arc-minute-long elliptical mist with a bright middle. The low-power field included M82, which was a fainter, patchy streak of similar length. It is this pretty pairing for which these galaxies are justly famous.

I inserted a 200x eyepiece and centred M81. Within the central bulge, I saw a gleaming, compact core and a starlike nucleus. From the hub, diffuse "wings" spread northward and southward. Two faint field stars appeared in the southern wing. (See Bill Batchelor's superb image of M81's spiral arms winding far beyond those superposed stars on page 7 of the May/June 2014 *SkyNews*.) Alas, my M81 spanned only 12 arc minutes, not 27. But eight arc minutes south-southwest of M81, I spotted a nice little bonus: two binary stars 2¼ arc minutes apart. Struve 1387 (Σ**1387**), comprising identical 10.7-magnitude components separated by 8.9 arc seconds, resolved easily. The 9.3-magnitude suns of Σ**1386**, just 2.1 arc seconds apart, split at 280x.

Contrasty M82 took the high magnification extremely well. At 200x, the galaxy still appeared roughly as long as M81. However, while the western third of the narrow cloud was bright, the eastern third was surprisingly tenuous. I had to use averted vision to trace it. The most intriguing part was the middle, which was irregular in outline and a bit brighter and thicker than the rest of M82. Indeed, the western portion of the middle third seemed almost cut in half by dark wedges "biting" into each flank. It was such an engrossing feature that I considered M82 a more interesting study than M81. Beast trumped Beauty!

What would a smaller telescope see? In my 4¼-inch Newtonian at low power, the galaxies were mere wisps, but at 93x, most of the essential details materialized. In my observing log, I wrote: "M81: bright middle, almost stellar centre. Averted vision shows wispy wings. South wing nearly reaches innermost of two very dim field stars. I can resolve binary Σ1387 but not Σ1386. M82: fainter overall but more interesting. Western half easy, eastern end extremely tenuous. Gradually brighter and thicker toward the middle. Core patchy and irregular. Nice!" ✦

Contributing editor Ken Hewitt-White has observed deep-sky fuzzies over southern British Columbia for more than four decades.

STAR CHART *for Early Spring*

OUR CHART SHOWS the major stars, planets and constellations visible from Canada and the northern United States within one hour of these times:

EARLY MARCH: 11 P.M.; LATE MARCH: 11 P.M.*
EARLY APRIL: 10 P.M.*; LATE APRIL: 9 P.M.*

*DAYLIGHT TIME

THE EDGE OF THE CHART represents the horizon; the overhead point is at centre. On a moonless night in the country, you will see more stars than are shown here; deep in the city, you will see fewer. The ecliptic is the celestial pathway of the Moon and planets. The star groups straddling this line are known as the zodiac constellations. The Moon is shown for selected dates.

USING THE STAR CHART OUTDOORS: The chart is most effective when you use about one-quarter of it at a time, which roughly equals a comfortable field of view in a given direction. Outdoors, match the horizon compass direction on the chart with the actual direction you are facing. Don't be confused by the east and west points on the chart lying opposite their location on a map of the Earth. When the chart is held up to match the sky, with the direction you are facing at the bottom, the chart directions match the compass points. For best results when reading the chart outdoors, use a small flashlight heavily dimmed with red plastic or layers of brown paper. Unfiltered lights greatly reduce night-vision sensitivity.

CELESTIAL CALENDAR

MAR. 2 Waxing gibbous Moon 5° below Jupiter in evening sky

MAR. 4 Venus and Uranus 0.3° apart in evening sky

MAR. 5 Full Moon, 1:05 p.m., EST; smallest full Moon of 2015, the anti-supermoon

MAR. 8 Daylight time begins (set clocks ahead one hour); zodiacal light visible in evening sky for next two weeks

MAR. 10 Mars and Uranus 0.5° apart tonight and tomorrow in evening sky

MAR. 12 Waning gibbous Moon 2° above Saturn in morning sky

MAR. 13 Last-quarter Moon

MAR. 14 Saturn stationary; begins retrograde motion 0.5° above nu Scorpii

MAR. 20 New Moon, 5:36 a.m., EDT; total solar eclipse visible from North Atlantic; partial solar eclipse visible from Newfoundland at sunrise
plus…
Equinox, 6:45 p.m., EDT (spring officially begins in northern hemisphere)

MAR. 21 Thin waxing crescent Moon 1.5° south of Mars in evening sky

MAR. 22 Waxing crescent Moon 3.5° south of Venus in evening sky

MAR. 24 Crescent Moon within the Hyades star cluster in evening sky

MAR. 27 First-quarter Moon

MAR. 29 Waxing gibbous Moon 5° below Jupiter in evening sky

APR. 4 Full Moon, 8:06 a.m., EDT; total lunar eclipse visible in predawn hours from western Canada; partial phases visible from eastern Canada

APR. 8 Waning gibbous Moon 1° above Saturn in morning sky; Jupiter completes retrograde motion 5° east of Beehive star cluster

APR. 10 Venus passes 3° south of Pleiades for next three nights

APR. 11 Last-quarter Moon

APR. 18 New Moon, 2:57 p.m., EDT

APR. 19 Waxing crescent Moon 4° from Mars and 7° from Mercury in evening sky

APR. 21 Waxing crescent Moon 7° south of Venus in evening sky; Moon occults Aldebaran in morning daytime sky

APR. 22 Mercury passes 1.3° north of Mars in evening sky; Lyrid meteor shower peaks under moonless skies; Saturn passes 1.2° north of beta Scorpii over next week in morning sky

APR. 25 First-quarter Moon; Moon 7° below Jupiter tonight and tomorrow in evening sky

APR. 30 Venus 3° south of Elnath (beta Tauri); Mercury passes 1.5° south of Pleiades low in evening sky

Impressive or relatively rare astronomical event

THE PLANETS

MERCURY climbs into the western twilight sky at the end of April as it begins its best evening appearance for the year from Canada. On April 22, Mercury, then at magnitude –1.3, passes just over a degree north of dimmer Mars, at magnitude 1.4.

VENUS, at a brilliant magnitude –4, dominates the spring evening sky. Venus climbs higher through the season, passing south of the Pleiades from April 10 to 12. The crescent Moon passes Venus on March 22 and April 21.

MARS remains in our evening sky as a first-magnitude reddish "star" low in the western twilight. However, Mars becomes increasingly more difficult to see as spring progresses, fading and dropping closer to the Sun.

JUPITER shines brightly in Cancer in the eastern sky each evening, dimming slightly from magnitude –2.5 to –2.1 over the season. The gibbous Moon passes Jupiter in wide conjunctions on March 2, March 29 and April 25.

SATURN rises around 2 a.m. at the beginning of March, but by the end of April, it is rising at about 11 p.m. Saturn brightens from magnitude 0.5 to 0.1 as it retrogrades above the stars nu Scorpii and beta Scorpii, in the head of Scorpius.

URANUS can be found as a 5.9-magnitude object low in the western evening sky in early March. Venus passes just 0.3° above Uranus on March 4, while Mars and Uranus pass within 0.5° of each other on March 10 and 11.

NEPTUNE lies too close to the Sun to see for most of the spring, emerging from the Sun's glare in Aquarius only at the end of April.

Cartography and design by Roberta Cooke.
Base chart data derived from maps drawn by Roy Bishop for the *Observer's Handbook*, published by The Royal Astronomical Society of Canada.

For more detailed information, see the *Observer's Handbook 2015*, published by The Royal Astronomical Society of Canada (www.rasc.ca or 888-924-7272).

ROTATING NIGHT SKY: During the night, the Earth's rotation on its axis slowly shifts the entire sky. This is the same motion that swings the Sun on its daily east-to-west trek. The rotational hub is Polaris, the North Star, located almost exactly above the Earth's North Pole. Everything majestically marches counterclockwise around it, a motion that becomes evident after about half an hour.

CONSTELLATIONS: The star groups linked by lines are the constellations created by our ancestors thousands of years ago as a way of mapping the night sky. Modern astronomers still use the traditional names, which give today's stargazers a permanent link to the sky myths and legends of the past.

LUNAR ECLIPSE AT EASTER

A total lunar eclipse, the third in the last 12 months, darkens the full Moon for western North America on Easter weekend. Venus climbs high into the west to shine brightly as an evening 'star' for the first time since 2013

by Alan Dyer

THE SPRING SKY IS GENEROUSLY ENDOWED WITH PLANETS. At the end of April, you can sight all five naked-eye planets in one night, with Mercury and Mars paired low in the evening twilight and Saturn rising in Scorpius late at night. However, the two brightest planets, Jupiter and Venus, dominate spring evenings on opposite sides of the sky.

Jupiter is now in its prime position for evening viewing as it sits in the eastern sky near the Cancer-Leo border. At a magnitude of –2.5 in early March (dimming only slightly to –2.1 by late April), Jupiter outshines anything else in the eastern spring sky. You can't miss it.

The western sky is marked by brilliant Venus, dazzling even brighter than Jupiter, at a magnitude of –4. Through March and April ,Venus climbs into the west, making a beautiful appearance high and bright in our evening sky.

EASTERN EVENING 'STAR': JUPITER

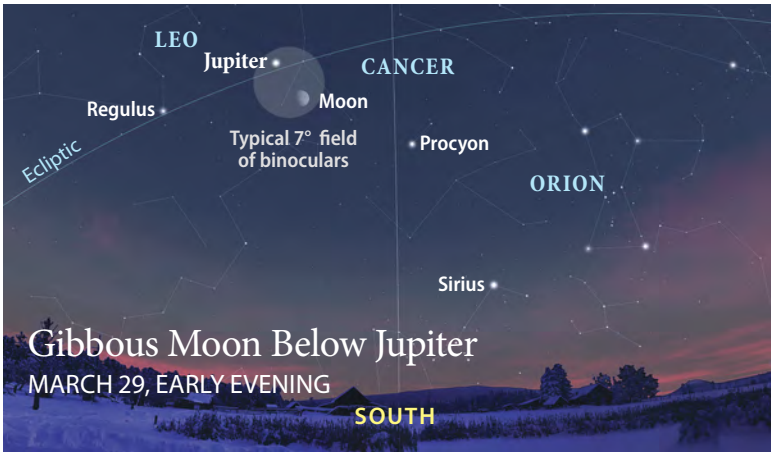
Look east at nightfall to see Jupiter blazing as the brightest object in that part of the sky. Jupiter now sits in the dim constellation of Cancer the crab, between the bright stars of Castor and Pollux in Gemini above and Regulus in Leo below.

Jupiter is now past opposition, when it was closest to Earth and brightest for the year. That was back on February 6. While Jupiter fades and shrinks slightly as Earth pulls away from the giant planet this spring, Jupiter's more convenient placement high in our evening sky at nightfall makes up for its declining brilliance and size.

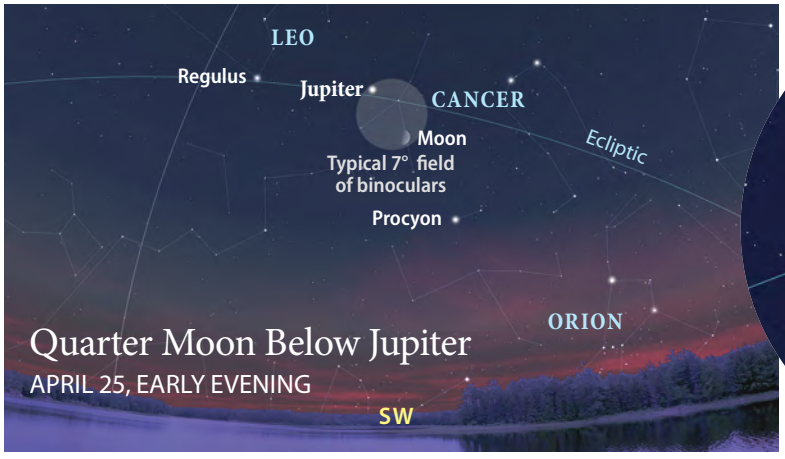
MOON AND JUPITER IN THE SOUTHEAST In the first of three passages of the Moon past Jupiter in March and April, the waxing Moon is three days before full on March 2. The two worlds shine in the southeast, while Orion, the iconic constellation of winter, shines due south.

MOON AND JUPITER IN THE SOUTH Nearly a month later, on March 29, the Moon is back by Jupiter, but now as a gibbous Moon just past quarter phase. The sky has advanced with the season, placing Orion in the southwest and the Moon-Jupiter pair high in the south.

COURTESY STARRY NIGHT PRO PLUS™/SIMULATION CURRICULUM CORP. (BOTH)

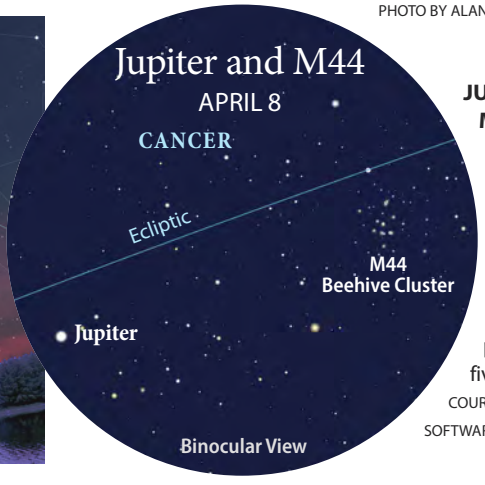


MOON AND JUPITER IN THE SOUTHWEST Another month later, on April 25, the Moon, now at first-quarter phase, passes Jupiter again. The pairing sits high in the southwest. The departure of Orion, sinking into the west at nightfall, signals the arrival of spring. COURTESY STARRY NIGHT PRO PLUS™/ SIMULATION CURRICULUM CORP.



THE NIGHTSIDE OF THE MOON Spring brings great nights for spying the dark side of the Moon, when sunlight bouncing off the Earth's day side illuminates the Moon's nightside. The best nights are March 21 to 24 and April 20 to 23, when the waxing crescent Moon shines high in the evening sky.

PHOTO BY ALAN DYER



JUPITER ALMOST MEETS M44 On April 8, Jupiter stops its westward retrograde motion just shy of the Beehive star cluster, Messier 44, in Cancer. Use binoculars or a telephoto lens to frame the giant planet, now shining five degrees east of M44.

COURTESY THESKYX™/ SOFTWARE BISQUE

Even with its disc shrinking from 45 to 40 arc seconds across this spring, Jupiter still outranks any other planet for size in a telescope. As a result, its cloudy disc will reward you with far more detail. Look for the two parallel equatorial cloud belts and the thinner cloud belts in the temperate latitudes north and south.

The famous Great Red Spot has been shrinking in recent years and appears to be turning from a long oval shape into a more circular feature. It can be seen as a pale rust-coloured, perhaps greyish, oval on the south edge of the south equatorial belt. It will be visible roughly every other night when the side of Jupiter that contains the Red Spot is turned toward us.

A few mobile apps, such as SkySafari and Astromist, display when the Red Spot is visible for specific locations and dates. However, the Red Spot drifts west in longitude with respect to other cloud features, so the accuracy of such predictions requires using the current position for the Red Spot. This spring, it should be at about 230 degrees longitude. For the Red Spot's current longitude, see www.jupos.privat.t-online.de.

WESTERN EVENING 'STAR': VENUS

The other bright planet visible this season is Venus, shining prominently in the western twilight. Venus is ascending higher each night through March and April, brightening slightly from magnitude –3.9 to –4.2.

Venus presents us with a fine show this spring as it swings above the ecliptic, while the ecliptic itself swings up to a high angle with respect to the horizon. As a result, Venus now appears unusually high and sets much later than we're used to for a planet so close to the Sun. By early May, Venus won't set until midnight, putting it well up in the northwest even after the sky darkens. Casual observers will wonder what that incredibly bright object is in the late-night sky. Expect UFO reports to increase this spring.

Through a telescope, Venus remains a small featureless disc with a gibbous phase. It won't get interesting for telescopic observation until May to July, when its disc balloons in size and its phase rapidly wanes to a thin crescent as it advances along its orbit, rounds the Sun and swings into position between Earth and the Sun.

Apart from Venus's phase, its cloud cover always presents a featureless face for telescopic observers. But this spring, the planet's prime attraction is its brilliant naked-eye appearance in the evening twilight. Venus is all the more attractive when it appears in conjunction with other celestial objects. On March 22 and April 21, the waxing crescent Moon, its nightside illuminated by Earthshine, passes Venus in beautiful binocular scenes. The March 22 conjunction is the best, with Venus and the Moon 3.5 degrees apart.

During the second week of April, Venus

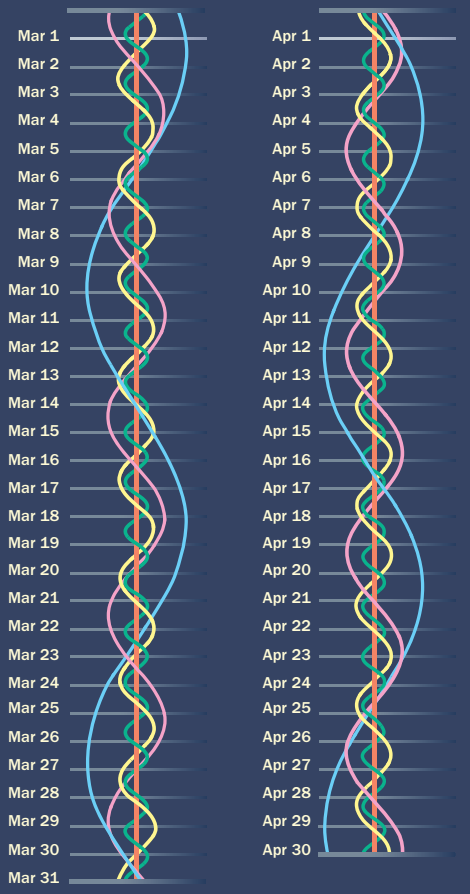
JUPITER'S MOONS

March and April 2015

The positions of Jupiter's four largest moons are shown for each night of the two-month period. Jupiter is represented by the central vertical shaft, while the moons are the four wavy lines. The horizontal lines mark 8 p.m., EDT, on the dates indicated. Time flows from top to bottom, so look proportionately below the line for later times on a particular date. East is to the left, and north is at the top, as seen in binoculars. From closest to farthest, the moons are Io, Europa, Ganymede and Callisto. Orbital periods are 1.8, 3.6, 7.2 and 16.7 days, respectively.

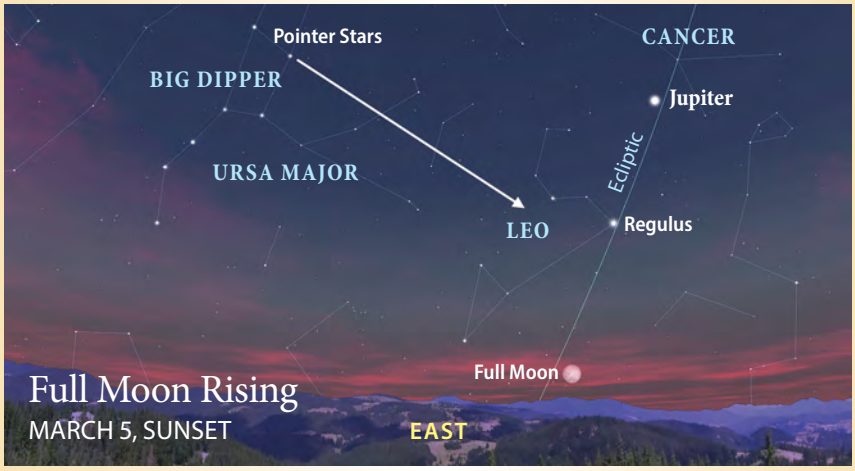
KEY:

Io Europa Ganymede Callisto



ANTI-SUPERMOONRISE **The smallest full Moon of 2015 occurs on March 5. Photograph it with the same telescope you will use to shoot the September 27 full "supermoon" and total lunar eclipse to get a comparison pair of small and large Moons. Note how the pointer stars in the Big Dipper's bowl point down to Leo and its bright star Regulus. Jupiter sits next door in the constellation Cancer.**

COURTESY STARRY NIGHT PRO PLUS™/SIMULATION CURRICULUM CORP.



LUNAR PASSAGES IN MARCH Spring begins with some fine examples of planetary meet-ups. The thin crescent Moon appears next to Mars on March 21 and Venus on March 22. Two nights later, the crescent Moon shines in the middle of the Hyades star cluster. COURTESY STARRY NIGHT PRO PLUS™/ SIMULATION CURRICULUM CORP. (ALL)

OCCULTATION NORTH OF 60 The Moon hides Aldebaran on the night of March 24/25, but only from northern Canada. This is the view from Yellowknife, Northwest Territories.

MOON MEETS MARS Use binoculars to pick out the razor-thin Moon next to Mars low in the bright twilight on March 21. The two appear roughly 1.5 degrees apart.

CONJUNCTION WITH VENUS The closest conjunction of the Moon and Venus this spring is on March 22, with the two-day-old Moon 3.5 degrees from brilliant Venus.

CRESCENT MOON AND CLUSTER Named for the legendary sisters of Greek mythology, the Hyades star cluster is visited by the waxing crescent Moon on March 24.

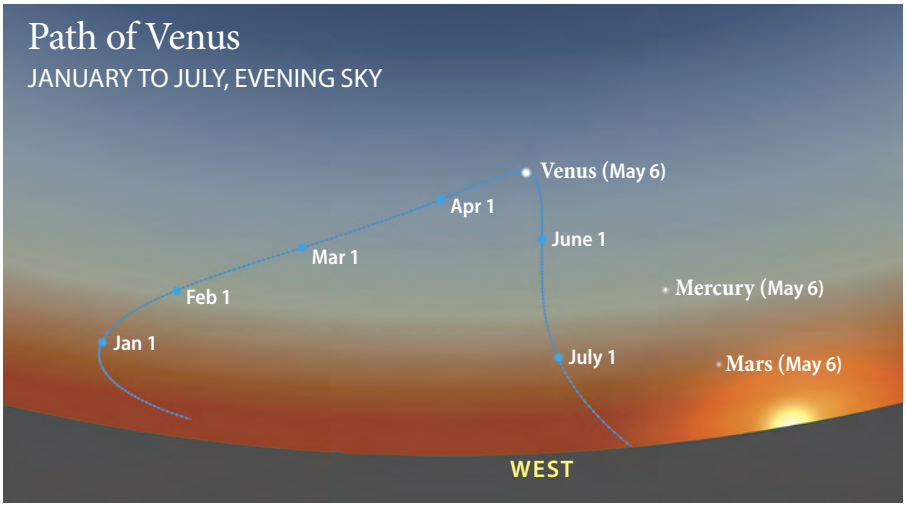
passes about three degrees south of the Pleiades star cluster, with closest approach on the evening of April 11. The pairing will make another binocular treat and a suitable scene for a telephoto lens and camera following the sky on a small tracking system.

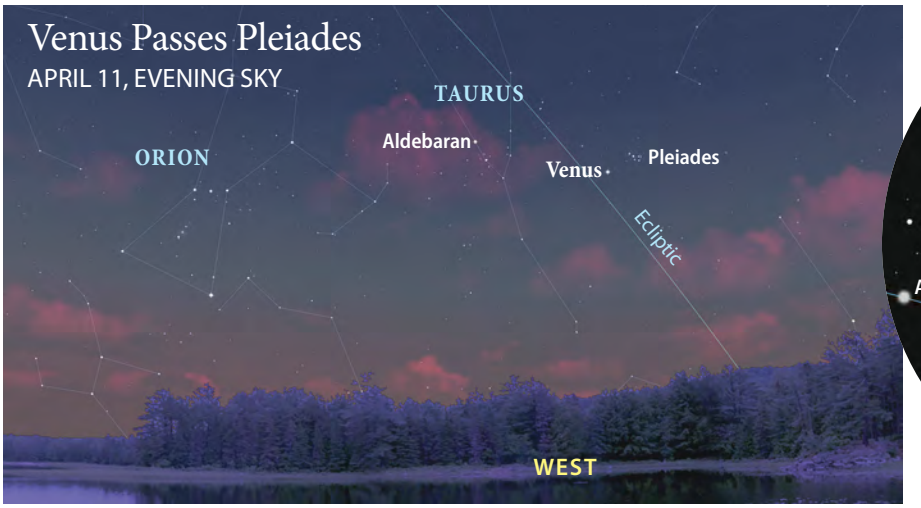
As April ends, Venus passes three degrees below the bright 1.7-magnitude star Elnath, marking the end of the northern horn of Taurus the bull. Elnath serves double duty in Auriga by completing the pentagon asterism that outlines Auriga, the mythological charioteer.

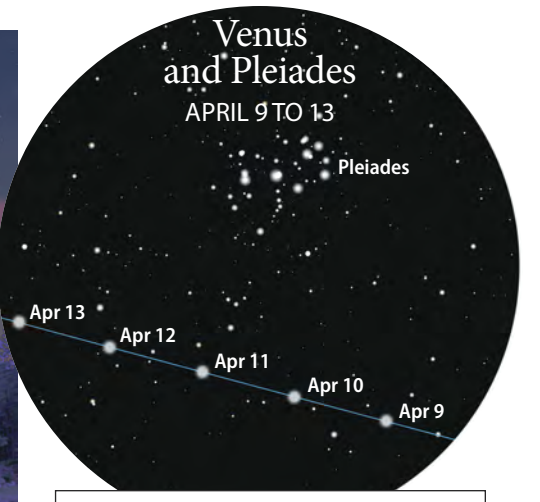
MOON IN HYADES

One red-letter evening to circle on your calendar is Tuesday, March 24. On that evening, the Earthlit crescent Moon sits amid the sparkling stars of the Hyades cluster, not far from Aldebaran, making a memorable binocular sight.

THE RISE AND FALL OF VENUS The illustration below plots the position of Venus relative to the horizon at sunset for Canadian latitudes as the planet ascends into our spring evening sky. While Venus reaches its greatest angle away from the Sun on June 6, it climbs to its highest altitude above the horizon in early May. The position of the three western-sky planets are shown for May 6. After that, Venus descends rapidly into the summer twilight. COURTESY THESKYX™/SOFTWARE BISQUE

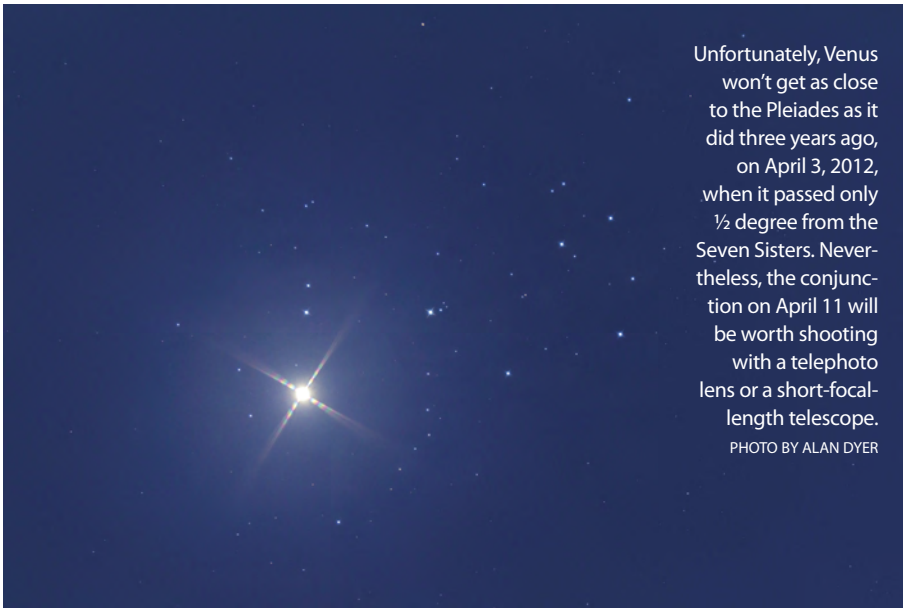






EVENING 'STAR' GREETS SEVEN SISTERS During the second week of April, Venus passes within a high-power binocular field of the Pleiades star cluster, also known as the Seven Sisters. Venus lies closest to the cluster on April 11. COURTESY STARRY NIGHT PRO PLUS™/SIMULATION CURRICULUM CORP.

PASSING BY THE PLEIADES The evenings before and after April 11 provide other excellent opportunities to see and shoot Venus near the Pleiades. On April 10 and 12, their separation is still three degrees—within an eyepiece view of a wide-field telescope.



Unfortunately, Venus won't get as close to the Pleiades as it did three years ago, on April 3, 2012, when it passed only ½ degree from the Seven Sisters. Nevertheless, the conjunction on April 11 will be worth shooting with a telephoto lens or a short-focal-length telescope. PHOTO BY ALAN DYER

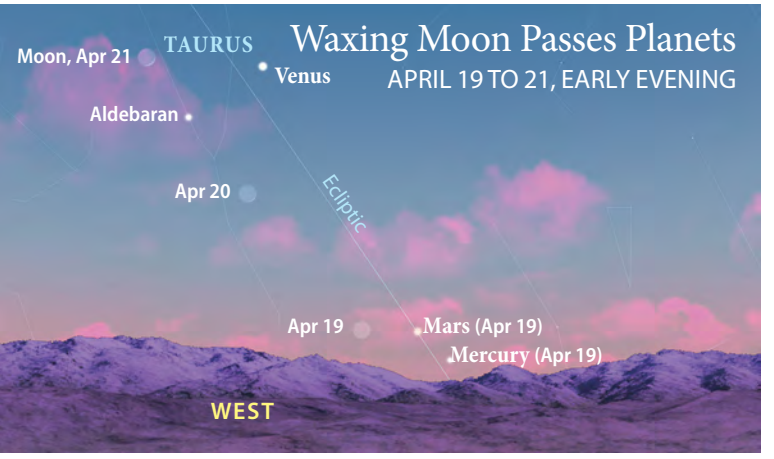
All of Canada can see this conjunction of cluster and crescent Moon. However, from Atlantic Canada, the Moon is just beginning to enter the Hyades as it sets. From locations farther west, the Moon's motion takes it more deeply into the V-shaped cluster that marks the face of Taurus the bull.

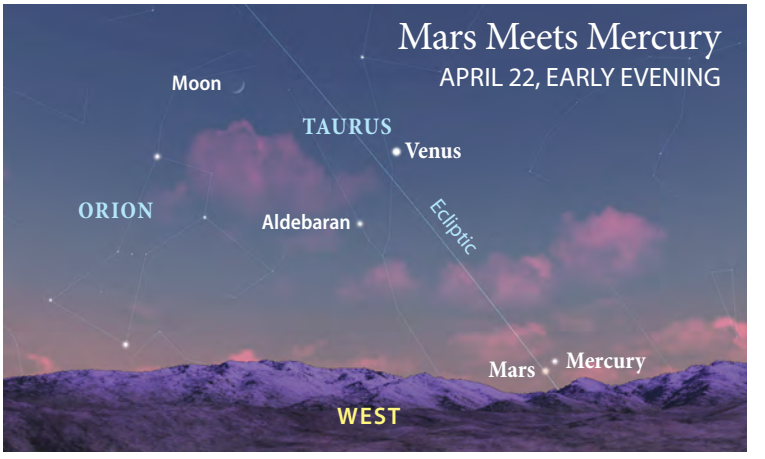
As the evening progresses, the eastward motion of the Moon along its orbit takes it in front of several of the brighter stars of the Hyades. You'll see them wink out in an instant as they disappear behind the advancing dark limb of the Moon in a series of stellar occultations.

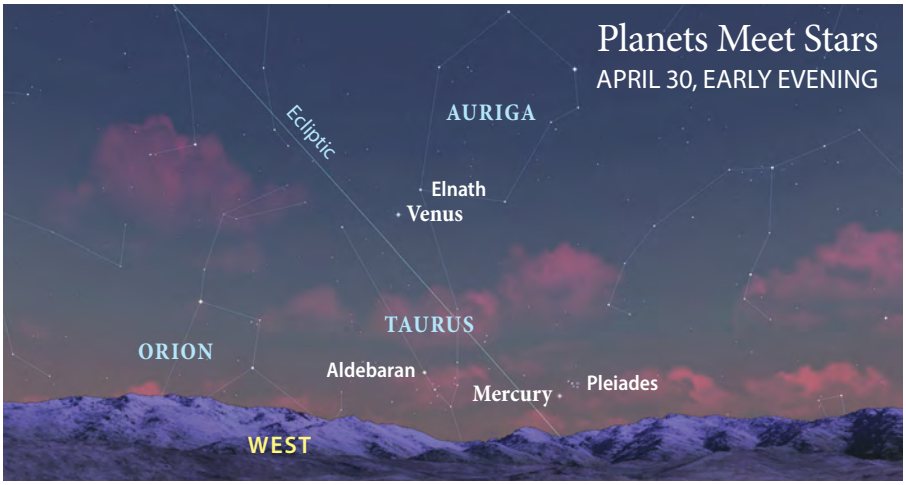
In fact, from Vancouver, the Moon oc-

LUNAR PASSAGES IN APRIL By the third week of April, Mars and Mercury have paired up low in the west. The thin Moon joins them on April 19, presenting a triangle of worlds in the west. Two nights later, on April 21, the crescent Moon shines higher, passing a wide seven degrees left of Venus to form a trio with Aldebaran, in Taurus.

MARS AND MERCURY IN CONJUNCTION On April 22, the Moon sits well above Venus, while Mars and Mercury have come together for a close conjunction a mere 1.3 degrees apart just above the western horizon. COURTESY STARRY NIGHT PRO PLUS™/SIMULATION CURRICULUM CORP. (BOTH)







A PAIR OF PASSAGES April ends with two conjunctions in the western evening sky: Mercury passes within 1.5 degrees of the Pleiades star cluster as the inner planet ascends in its best evening show of the year, while Venus lies three degrees south of the bright star Elnath, a.k.a. beta Tauri.
COURTESY STARRY NIGHT PRO PLUS™/SIMULATION CURRICULUM CORP.

cults bright Aldebaran itself just as the Moon sets. This occultation is more easily seen farther north, where the Moon sets much later. From Yellowknife, the Moon hides Aldebaran at 1:33 a.m., MDT, on March 25, about an hour before local moonset.

As with the Venus-Pleiades meeting, the waxing Moon surrounded by the Hyades is an ideal photographic target for a telephoto lens (135mm to 300mm) using a camera piggybacked on an equatorial mount with a motor drive or on one of the dedicated tracking devices manufactured by companies such as Sky-Watcher, iOptron and Vixen. Try to catch the scene early, while the sky is still illuminated by deep blue twilight, so that the bright crescent Moon will be less glaring.

LOW IN THE TWILIGHT: MERCURY

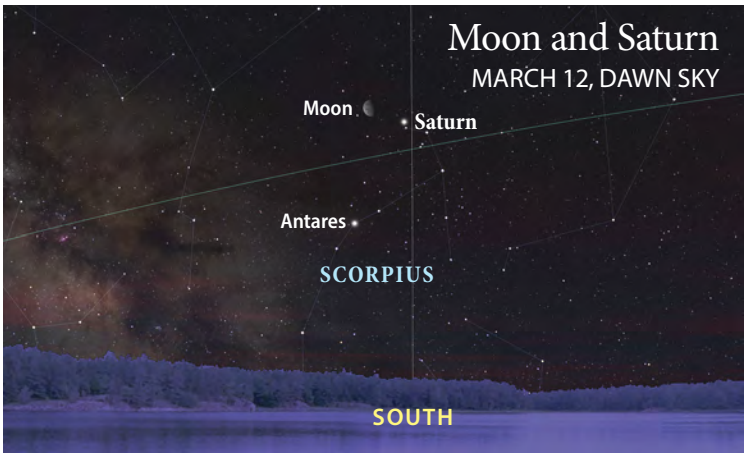
Spring is always the best season for sighting Mercury in the evening sky. The inner planet reaches its greatest elongation from the Sun on May 6. The last week of April sees Mercury swing up into our evening sky at the start of this favourable opportunity. As Mercury rises into view on April 19, the thin waxing Moon passes a binocular field south of Mercury, making this a good night to find the small planet. Then, three nights later, Mercury on the ascent passes Mars as that world sinks toward the Sun. A week later, on April 30, Mercury passes south of the Pleiades star cluster as the Seven Sisters make their last evening appearance in our spring sky.

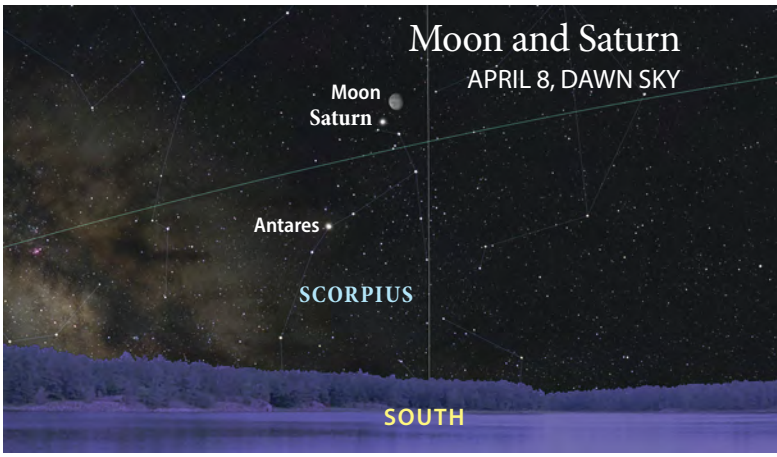
The final week of April is your chance to

A DAYLIGHT DISAPPEARANCE
Throughout 2015, the Moon passes in front of Aldebaran on a monthly basis. Most of these occultations occur above distant parts of the globe and are not favourably positioned and/or timed for southern Canada. However, on the morning of April 21, the waxing crescent Moon hides Aldebaran, although this occultation occurs in the bright daylight sky. Manitoba is the best place to see this event. Aldebaran disappears behind the dark, invisible advancing limb of the Moon at 10:26 a.m., CDT, with the Moon 16 degrees high. The star reappears on the opposite bright limb of the Moon at 11:10 a.m., CDT. To optimize the viewing conditions, use a telescope equipped with a red filter to darken the blue daylight sky.
COURTESY STARRY NIGHT PRO PLUS™/SIMULATION CURRICULUM CORP.

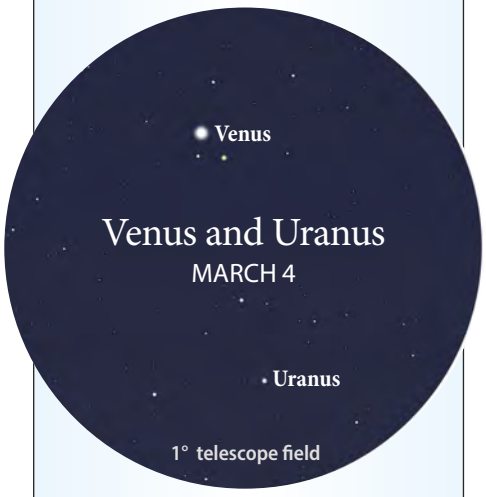
MOON AND SATURN IN SCORPIUS I Saturn shines in Scorpius this spring, just ½ degree north of the fourth-magnitude star nu Scorpii, or Jabbah. On March 12, the waning gibbous Moon passes two degrees north of Saturn in the brightening predawn sky.

MOON AND SATURN IN SCORPIUS II Nearly a month later, the waning Moon is back by Saturn, this time passing a close one degree above the ringed planet. The pairing lies due south by about 4 a.m., local time, but shines in the southwest by dawn.
COURTESY STARRY NIGHT PRO PLUS™/SIMULATION CURRICULUM CORP. (BOTH)

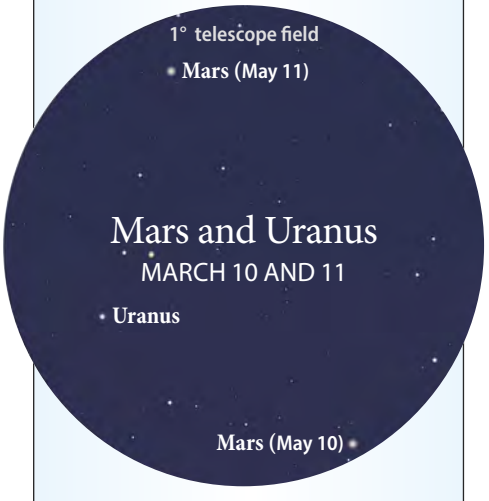




CONJUNCTIONS WITH URANUS AT DUSK If you have never seen Uranus, these nights provide a great opportunity. However, sighting these close conjunctions will take a telescope and a site with a clear and unobstructed sky to the west. Expect Uranus to look like no more than a pale green star with a barely perceptible disc at moderate to high power.



BRIGHT AND DIM PLANETS MEET
At magnitude –3.9, Venus outshines Uranus by nearly 10 magnitudes, making it about 10,000 times brighter than faint 5.9-magnitude Uranus. On March 4, Venus passes less than a Moon diameter (20 arc minutes, or 0.3 degree) above Uranus.



RED PLANET MEETS GREEN WORLD
A week later, it is Mars' turn to meet Uranus. On March 10 and 11, the red planet passes 0.5 degree from green Uranus. This will be a more difficult sighting, as Mars and Uranus lie low in the western twilight.
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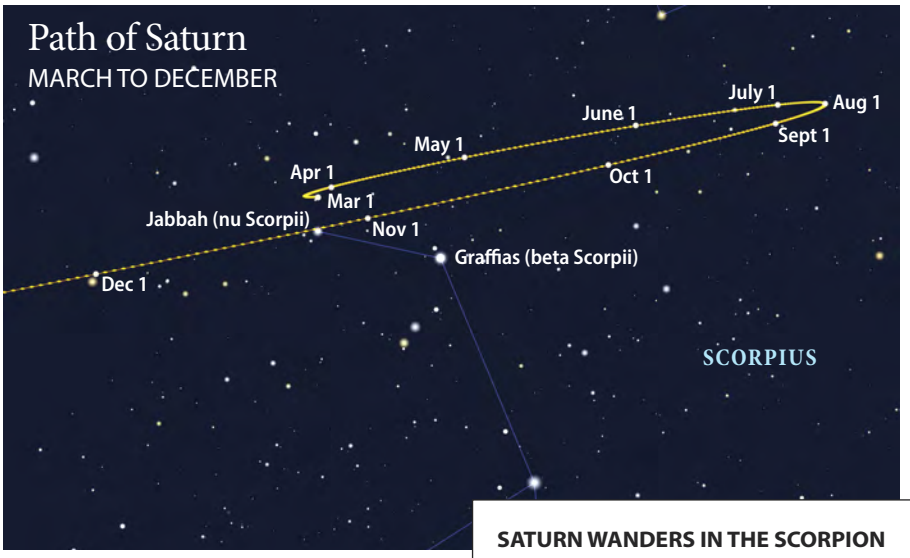

SATURN WANDERS IN THE SCORPION
Beginning its retrograde motion this season, Saturn commences its backward loop among the stars on March 14 as it shines just above Jabbah (nu Scorpii). It moves westward, passing 1.2 degrees above the 2.6-magnitude double star Graffias (beta Scorpii) during the last week of April. Saturn continues to retrograde until August 2. It then loops eastward again through the late summer and autumn, passing even closer to Jabbah and Graffias in late October and early November.
COURTESY THESKYX™/SOFTWARE BISQUE

sight all five naked-eye planets in one night, starting with the Mercury-Mars duo low in the west. Catching Saturn requires a late-night wait for Scorpius to rise.

PREDAWN PLANET: SATURN

While the evening planets steal the show this spring, Saturn is beginning its 2015 appearance as a bright object in the head of Scorpius. In early March, Scorpius doesn't rise until 2 a.m. But by the end of April, Saturn and Scorpius are coming up at a decent hour, by 11 p.m. However, the ringed planet isn't due south and worth inspecting in a telescope until the wee hours of the morning.

Saturn's prime season comes later in the year, in late spring and early summer. If you do sight Saturn during a predawn session this season, you'll see it sitting just above the bright stars nu Scorpii and beta Scorpii, part of the head of the scorpion.

Saturn is currently retrograding above those stars, both of which are fine double stars. Indeed, nu Scorpii, which also goes by the name Jabbah (no relation to the *Star Wars* character), is nicknamed the southern Double-Double. Like the more famous northern Double-Double in Lyra, each of Jabbah's widely separated components is itself a close double. Be sure to take a look at Jabbah when you are next in the area observing Saturn.

TOTAL LUNAR ECLIPSE AT EASTER AND PASSOVER

On Saturday, April 4, the full Moon passes through the Earth's umbral shadow for the third time in a year, providing us with another wonderful total eclipse of the Moon. This is the third in a tetrad of total lunar eclipses, with four in a row at six-month intervals. The last such tetrad was in 2003-2004. The next quadruple set won't be until 2032-2033.

Unfortunately, because of the timing of this eclipse in Canada, only those west of the Manitoba-Ontario border can see the total phase of the eclipse.

This eclipse is unique for being about as short as a lunar eclipse can be and still be called total. Totality lasts a mere 4 minutes 31 seconds, almost like a total solar eclipse and a far cry from the hour that most total lunars last. To find a previous total lunar eclipse as short as this one, according to eclipse expert Fred Espenak, you have to go back to October 17, 1529.

This total lunar eclipse is also unique for *when* it happens. In Canada, it occurs on the Saturday morning on the day before Easter, the first full day of Passover. For those on the other side of the international date line, as in Australia and New Zealand, where the eclipse is also visible, the Moon is eclipsed late Saturday evening, April 4, and into the postmidnight hours of Sunday, April 5. So for some areas, the lunar eclipse occurs on Easter Sunday.

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Easter is set (usually!) as being the Sunday following the first full Moon after the spring equinox. (By contrast, Passover begins at the first full Moon after the equinox, so it always coincides with a full Moon.) But for some time zones this year, the full Moon and Easter are on the same day. How can that be?

The ecclesiastical calculations of Easter follow rules set down centuries ago. First, the rules assume a fixed date for the equinox, March 21. In 2015, the moment of equinox actually falls on March 20 for some time zones (for example, at 6:45 p.m., EDT). In addition, the official calculations of Easter use a theoretical Moon and an idealized table of paschal (Passover) full Moon dates, which can differ from the dates of the real full Moon by up to two days.

In 1981, for instance, the real astronomical full Moon fell on Easter Sunday, April 19, but the ecclesiastical paschal full Moon fell on April 18. So, while rare, it is possible to have a full Moon on Easter, despite the fact that Easter Sunday is supposed to *follow* the full Moon.

Not only do we have a full Moon at or close to Easter this year, but that full Moon is also totally eclipsed. How often does that occur? According to astro-mathematician Jean Meeus, in his book *More Mathematical Astronomy Morsels*, the last total lunar eclipse to occur on an Easter Sunday was on March 23, 1913, two days after the equinox. The next total lunar eclipse at Easter won't be until April 14, 2340! So enjoy this eclipse for both its odd duration and its rare date.

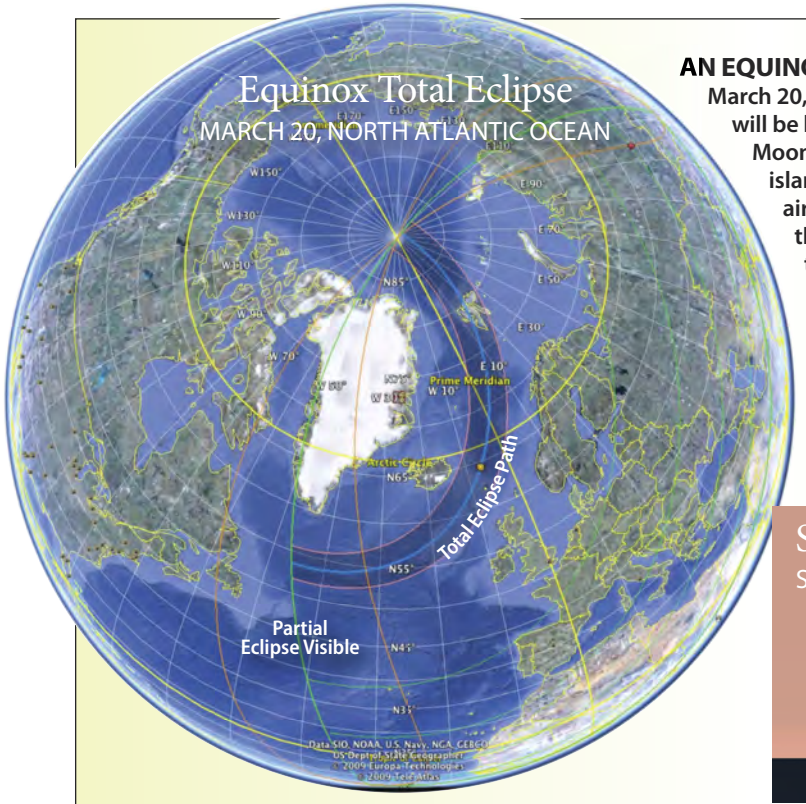
VIEWING THE ECLIPSE

Because this eclipse is so short, the Moon won't get very dark during totality. As the Moon grazes the inside edge of our planet's umbral shadow, its northern limb will remain very bright, giving the reddened Moon the appearance of having a Mars-like polar cap. If you're planning to photograph the eclipse, work fast during totality. You have only a few minutes, and it may not be visually obvious exactly when totality begins or ends. Watch your time.

From the Prairie Provinces, the Moon will be sitting in a brightening predawn sky during totality, making for some colourful wide-angle photos. The Moon setting during the partial phases, which is true for much of Canada, will also lend itself to some interesting images of the low, partially eclipsed Moon over a scenic landscape. Only from the West Coast does the entire lunar eclipse play out in a mostly dark predawn sky.

As with any lunar eclipse, this one is safe to look at using any optics. It is eclipses of the Sun that can be dangerous to view, requiring dense, safe filters. To view the April 4 lunar eclipse, use binoculars or a telescope at low power to better reveal the subtle colour gradients across the disc of the Moon.

If you miss this event, you'll have one more chance in 2015 to see a lunar eclipse before we experience a gap of nearly 2½ years until the next total lunar eclipse visible from anywhere on Earth, on January 31, 2018. On the evening of Sunday, September 27, all of North America can watch the last of the lunar eclipse tetrad. That eclipse coincides with a close perigee "supermoon," so you can be sure the web will be buzzing with yet more peculiar predictions from the fearful fringe (cue spooky music). ✦



AN EQUINOX SOLAR ECLIPSE **On the day of the spring equinox, March 20, the Moon totally eclipses the Sun. Die-hard eclipse chasers will be heading to the only landfall the umbral shadow of the Moon makes: the Faroe Islands north of Scotland or the Arctic island of Svalbard. Others will choose to view the eclipse from aircraft chasing the shadow over the North Atlantic. Uniquely, this eclipse can also be witnessed from the North Pole, with the eclipsed Sun on the horizon as the pole begins to bask in six months of daylight. Will any well-heeled umbraphiles pay for that rare privilege and bragging rights?**

All of Europe will see a substantial partial eclipse. Check the RASC's *Observer's Handbook 2015* for exact times for European locations. From Canada, only the eastern portions of Newfoundland, Labrador and Baffin Island will see any part of this eclipse, and it's a small part.

NORTH ATLANTIC SHADOW PATH To see the March 20 solar eclipse as a total eclipse, dedicated shadow chasers will have to venture into the 400-kilometre-wide path that the Moon's umbra will sweep across the North Atlantic. COURTESY GOOGLE EARTH AND XAVIER JUBIER

PARTIAL SUNRISE From St. John's, Newfoundland, the Sun rises with 28 percent of its face covered by the Moon. The eclipse ends just 22 minutes later, a brief sideshow to the main event happening across the Atlantic. COURTESY STARRY NIGHT PRO PLUS™/SIMULATION CURRICULUM CORP.

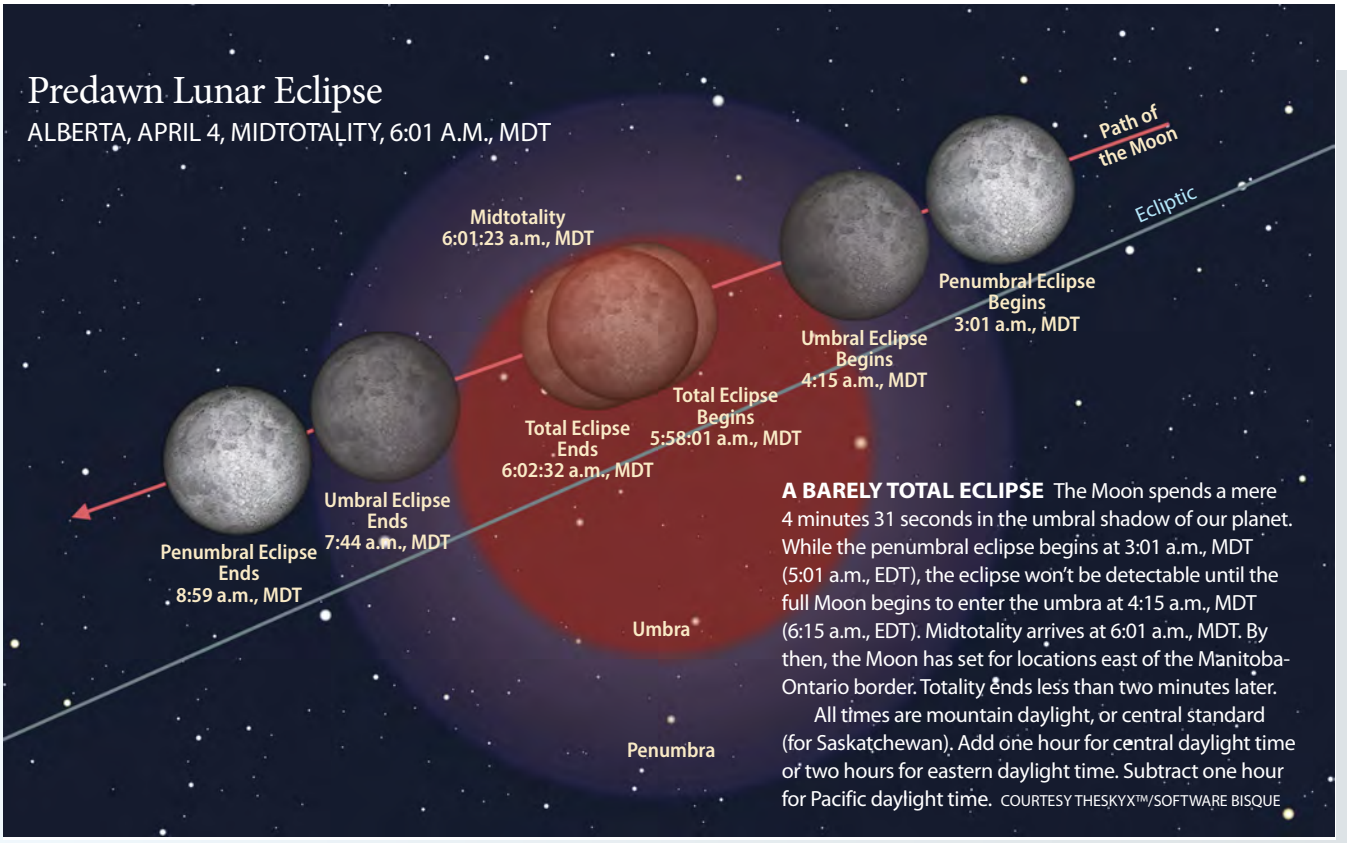
TOTAL ECLIPSE *of the Moon*

The main event of the season is the total lunar eclipse in the wee hours before dawn on April 4 for Canadian locations. It is *not* in the evening on April 4 or in the predawn hours on April 5. So don't miss it!

Unlike last year's two total eclipses of the Moon, on April 15 and October 8, 2014, which most, if not all, of Canada could see, this event can be seen as a total eclipse only from western Canada. Ontario and western Quebec see just the initial partial eclipse.

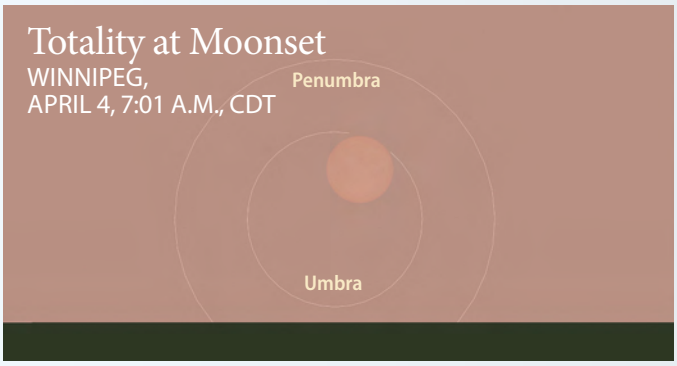
SHADES OF RED ON THE MOON As it did on October 8, 2014 (above), the full Moon will turn red on April 4 as it passes through the Earth's umbral shadow. At this point, the only light illuminating the Moon comes from reddened sunlight being refracted into our planet's shadow by the Earth's atmosphere. The Moon will pass across the northern part of the umbra, leaving the northern limb of the Moon bright, perhaps yellow or even white, fading to a darker red toward the south pole of the Moon, which is more deeply immersed in the shadow. PHOTO BY ALAN DYER

ECLIPSE FROM ALBERTA From southern Alberta, the totally eclipsed Moon will glow a bright red, at an altitude of 10 degrees in the west-southwest, as the dawn sky brightens. The Moon sets while partially eclipsed. COURTESY STARRY NIGHT PRO PLUS™/SIMULATION CURRICULUM CORP.

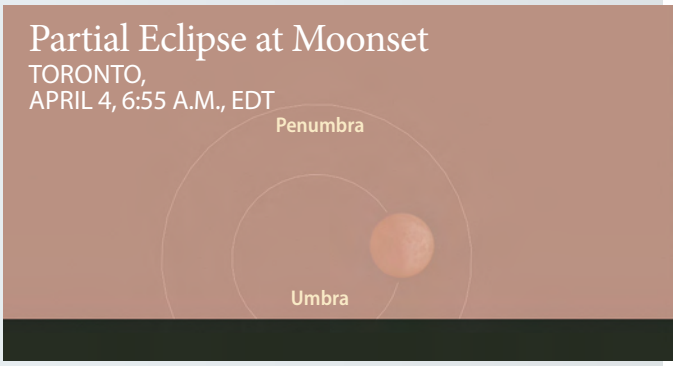


A BARELY TOTAL ECLIPSE The Moon spends a mere 4 minutes 31 seconds in the umbral shadow of our planet. While the penumbral eclipse begins at 3:01 a.m., MDT (5:01 a.m., EDT), the eclipse won't be detectable until the full Moon begins to enter the umbra at 4:15 a.m., MDT (6:15 a.m., EDT). Midtotality arrives at 6:01 a.m., MDT. By then, the Moon has set for locations east of the Manitoba-Ontario border. Totality ends less than two minutes later.

All times are mountain daylight, or central standard (for Saskatchewan). Add one hour for central daylight time or two hours for eastern daylight time. Subtract one hour for Pacific daylight time. COURTESY THESKYX™/SOFTWARE BISQUE



ECLIPSE FROM MANITOBA From Winnipeg, the brief period of totality occurs with the Moon just about to set in the west, barely one degree above the prairie horizon. As the Sun is rising at the same time, the Moon might be difficult to sight amid horizon haze.



ECLIPSE FROM ONTARIO From Toronto, the Moon sets at sunrise with a substantial partial eclipse in progress. A photogenic foreground could make for a great image. The farther west you are in Ontario, the more of the Moon is eclipsed at moonset.

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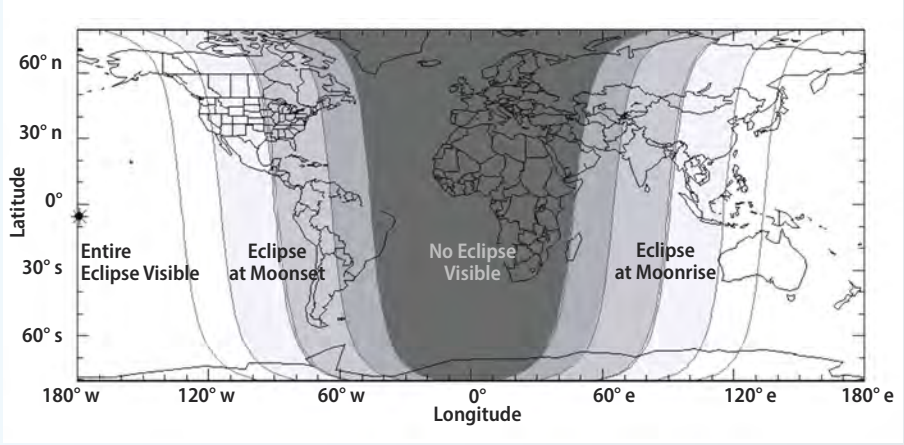

WHO CAN SEE THIS ECLIPSE IN CANADA?

Atlantic Canada and eastern Quebec "see" only the undetectable penumbral phase of this eclipse. Western Quebec and all of Ontario see the partial eclipse as the Moon enters the umbra. From a narrow zone along the Manitoba-Ontario border, the Moon sets during totality. West of that region, western Canadians can see all of totality, with some portion of the Moon still in partial eclipse in the umbra as the Moon sets at sunrise. Only the West Coast, northwestern British Columbia and Yukon see the entire eclipse right to the end of the partial umbral phase. COURTESY FRED ESPENAK/NASA GODDARD SPACE FLIGHT CENTER

MILKY WAY ON THE ROCKS

Our home galaxy, the Milky Way, is a fabulous sight from the Rocky Mountains

Alan Dyer shot this otherworldly image on September 14, 2014, on a rare, very clear night at the Columbia Icefield in Jasper National Park. The massive reservoir of ice straddling the Continental Divide usually generates clouds streaming off the mountains, but not this night. The photograph captures light from the waxing Moon rising in the east striking the peaks to the west. The sky above remains dark enough to reveal the summer Milky Way setting behind the Athabasca Glacier, at centre, and Mount Andromeda, at left. The image is a composite of five 3-minute exposures for the sky, with the camera riding on a Sky-Watcher Star Adventurer tracker. Four more exposures were taken of the ground, with no tracking, all with a 15mm lens at f/3.2 and a Canon 5D Mark II at ISO 1600. Stacking and masking the images in Photoshop produced the final portrait.

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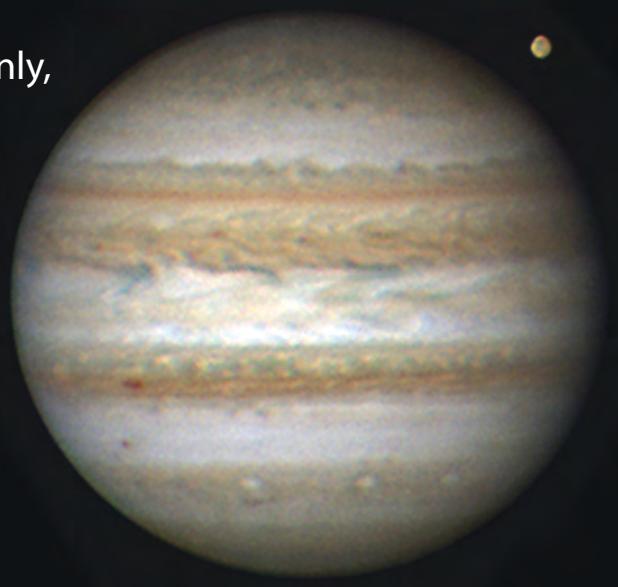

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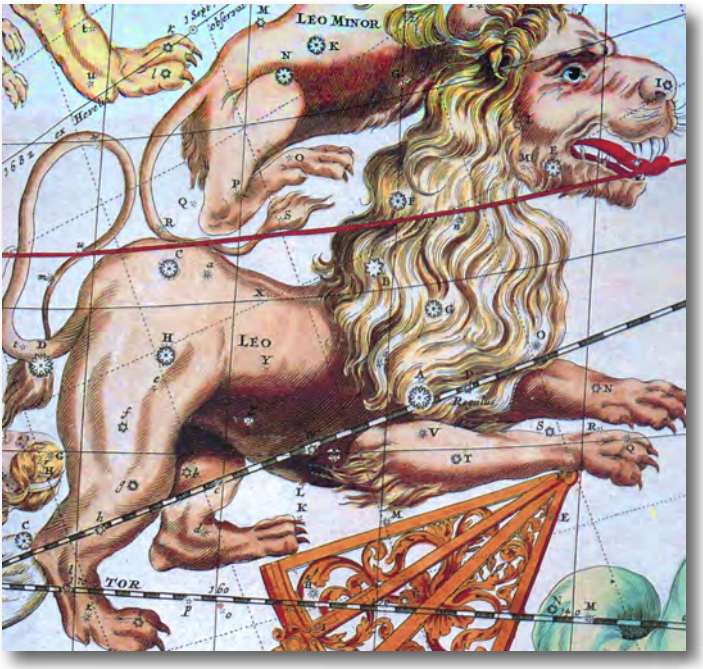
LEO

Behold the celestial king of beasts, one of the most prominent constellations in the zodiac *by Ken Hewitt-White*



PRESIDING SPHINX-LIKE over the spring night sky, Leo's star pattern really does suggest a lion in stately repose. In classical mythology, Leo was the creature slain by Hercules during the first of his grisly 12 labours. Leo's hide was considered impervious to stone and metal, so Hercules skinned the animal and wore the pelt as a suit of armour. The lion's head became a ghastly but effective helmet.

The head and mane are outlined in the sky by a backwards question mark of six stars known as the Sickle. At the base of this distinctive asterism is first-magnitude Regulus ("little king"), a name proffered by the famous Renaissance astronomer Copernicus. A better fit anatomically is the star's old Roman title, Cor Leonis ("heart of the lion"). The rump of the beast is indicated by a large triangle, whose eastern vertex is marked by second-magnitude Denebola ("the lion's tail").

Leo was once viewed as a much larger star figure than the one we recognize today. The face of the lion protruded into the constellation Cancer, where the Beehive star cluster marked Leo's nose. The curve of the Sickle became the beast's hairy shoulder, while the star Denebola established his hindquarters. Leo's tail curled into Coma Berenices, where the scatter of faint stars that comprise the Coma star cluster symbolized the tuft of fur on the lion's tail.

In Egyptian times, Leo was the most northerly constellation in the zodiac and the Sun passed Regulus near the date of the summer solstice. (Today, the Sun passes Regulus in late August.) Believing that the high-riding lion imparted extra strength to the Sun god, Egyptian astrologers honoured Leo as the "house of the Sun." (In fact, an Egyptian creation myth asserts that the Sun was born in Leo.) The annual flooding of the Nile River at the same time of year earned Leo even greater respect. It was no coincidence that Egyptian sculptors placed statues of lions at the gates of their canals.

Skywatchers in ancient China imagined several celestial characters in and around Leo. The most important was Hien-youen, the rain dragon, whose sinuous figure was created by connecting the Sickle stars with fainter points in Leo Minor. Chinese astronomer-priests claimed that the rain dragon represented the power of water, just as the Egyptians associated mighty Leo with the Nile River floods. ✦

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by Ivan Semeniuk

Doubling Down on Dark Matter

A second generation of experiments is opening new windows on the search for dark matter

GILLES GERBIER has been chasing dark matter for too long to think his quarry is about to drop into his lap. But after moving his home base from France to Queen's University, in Kingston, Ontario, he's poised to take his quest to the next level.

Last fall, the Canadian government helped Gerbier up the ante on dark matter by awarding him a $10 million Canada Excellence Research Chair in Particle Astrophysics. Part of his new role will involve bringing European collaborators in on an American-led dark matter experiment that is slated for installation at SNOLAB, the underground science laboratory located two kilometres below the surface in the Creighton Mine, near Sudbury, Ontario.

Dark matter is a familiar, if mysterious, presence to astronomers, who deduced its existence decades ago by measuring its gravitational influence on stars in the Milky Way and other galaxies. Since then, indirect evidence for dark matter has continued to mount, most recently from the Planck satellite, which used the relic light of the early universe to determine that there is 5.5 times more dark matter, by mass, in the universe than ordinary matter. Figuring out what all that dark matter is has become one of the great scientific challenges of the 21st century.

DARK MATTER ENIGMA Gilles Gerbier (below) examines a metal sphere of a type that could be used in a future dark matter detection experiment. Left: Researchers and engineers stand in a deep cavern at SNOLAB that will house the SuperCDMS.
COURTESY QUEEN'S UNIVERSITY (BELOW); SNOLAB (LEFT)

The most direct approach has been to build detectors that can spot the effects of dark matter passing by. Because interactions with dark matter particles are expected to be rare, such detectors must be both large and sensitive. The two-kilometre-thick bedrock above SNOLAB is no barrier to dark matter, but it forms a terrific shield against cosmic rays that would otherwise overwhelm a detector.

This is why SNOLAB has become prime real estate in the search for dark matter. And the diversity of experiments already under way there underscores the key challenge for Gerbier and his colleagues: how to design an experiment to spot something when you don't quite know what you're looking for.

The answer is to search in many different ways. This spring should see two dark matter experiments, dubbed DEAP-3600 and MiniCLEAN, switching on at SNOLAB. Both experiments use liquid argon as a detection medium. Their goal is to spot argon nuclei recoiling from occasional interactions with unseen particles of dark matter. This approach is best suited for detecting particles that are about 20 to 30 times heavier than a proton. But there is a chance that dark matter particles are much lighter than that—a possibility that Gerbier is particularly eager to explore.

The way to open that window, says Gerbier, is with the Super Cryogenic Dark Matter Search (SuperCDMS), an experiment that relies on a superconducting detector with layers of germanium crystals as the detection medium. As its name suggests, the experiment must be very, very cold to succeed. Exactly how cold is what researchers are now trying to determine, but it's clear that the operating temperature will have to be less than one hundredth of a degree above absolute zero.

The experiment is jointly backed by the U.S. Department of Energy and the National Science Foundation, which last year approved its construction at SNOLAB, and Gerbier is working on ways to combine the SuperCDMS with a parallel European experiment called Edelweiss. The cavern that will house the SuperCDMS is ready and waiting at SNOLAB. In the coming months, Gerbier anticipates the delivery of some key components, including the massive cryogenic chamber he simply calls "the fridge."

Meanwhile, other efforts may help guide the dark matter hunt. Among them is the Alpha Magnetic Spectrometer (AMS), a cosmic ray experiment bolted to the exterior of the International Space Station. Some of the cosmic rays it sees may be the ordinary matter by-products of dark matter particles colliding with one another.

Recent results confirm that the AMS has spotted an excess of positrons at energies that are consistent with this scenario. But other explanations have not yet been ruled out. More telling will be AMS's data on antiprotons, but those data are still a couple of years away, says Paolo Zuccon, a physicist at MIT and a member of the AMS team.

Coming up even sooner is the prospect that dark matter could be generated by high-energy collisions at the Large Hadron Collider (LHC), near Geneva, Switzerland. As this issue of *SkyNews* goes to press, the LHC is on the verge of restarting at about twice the energy level it attained when scientists there reported the discovery of the Higgs boson, in 2012.

"The restart at higher energies is interesting early on because all of a sudden, you have access to particles at a higher mass scale," says Pierre Savard, a University of Toronto physicist and group leader with ATLAS, one of the LHC detectors that verified the existence of the Higgs boson.

If nature is particularly kind, it is possible that the LHC, AMS and SuperCDMS will all converge on a result that will finally reveal the secret of dark matter. But, as Savard says, there are no guarantees.

What scientists can say is that the search for dark matter has, as of this year, entered a new phase on all fronts. The field has never been more exciting. ✦

Ivan Semeniuk is a science reporter for The Globe and Mail *newspaper and website. His columns appear regularly in* SkyNews.

by Ken Hewitt-White

Hitchhiker's Guide to a Comet

Late March 1970: Comet Bennett was entering our Canadian sky. I simply had to observe it, but that meant getting to a place in the sticks called the Quiet Site.

COSMIC LURE Comet Bennett was a fine sight from the northern hemisphere in late March 1970.
COURTESY GENEVA OBSERVATORY

FOR MY OTTAWA RASC chums, the Quiet Site was an astronomy haven—a private-access observing compound in a government research area about an hour's drive west of the city. It's empty now. The many student members, me among them, who met there during the Apollo era have long since scattered across the land. But I have a treasured keepsake: the Quiet Site sign-in log that we kept in our well-equipped warming hut. My entry for Wednesday, March 25, 1970, was: "02:10: Chris & Ken, here for the comet."

I knew that Comet Bennett was about to grace our dawn sky. I wanted to observe it from the Quiet Site, but the weather had been awful. Indeed, a snowy cold front was blasting through Ottawa on the afternoon of March 24, but the forecast promised clearing overnight. And school was out for the Easter break. Even so, none of my most valued friends—the ones with cars—were willing to drive in the snow. I couldn't understand their reticence. And neither could an impressionable young acolyte named Chris Martin, who agreed to my reckless suggestion of hitchhiking.

I can't recall what we told our respective parents, but after dark, Chris and I took a bus to the city limits. It was 11 p.m. when we stuck out our thumbs. A very long time passed. By midnight, the snow was tapering off but so was the traffic. We were getting frustrated. Clever Chris attached a one-dollar bill (remember those?) to the end of a stick and began waving it at approaching vehicles. One curious motorist slowed down but didn't stop—after all, it was only a dollar. To keep warm, we hiked as we hitched. Leaning into the brunt of an icy west wind, we were just barely cheered by the possibility of a clearing sky.

Eventually, some dear soul picked us up. Imagine his incredulity as I explained that farther along the highway, we'd like to stop at a "security checkpoint" to sign out keys so that upon arrival at the Quiet Site, we could unlock a steel gate and observe something called "Bennett." That man did pull in to the checkpoint (bless him), but later, he wouldn't detour down a lonely side road to the Quiet Site's main entrance. Your intrepid comet seekers had to walk the final five kilometres, not arriving at our hut until 2 a.m. The sky was still overcast. We booted my carefully stowed 8-inch reflector outside, set an alarm clock to ring at 4 a.m., crawled into our sleeping bags and nodded off.

Naturally, the alarm failed to work. Perhaps my subconscious sensed a date with destiny slipping away, because at 4:30 a.m., I leapt to my feet, scrambled over a comatose Chris and stumbled out the door. The storm had passed; all was calm, clear and *cold*. In jeans and a T-shirt, I gazed up, bleary-eyed, at a hundred fuzzy dots. I rubbed my eyes. All the blurs sharpened into pinpoints—except one. Low in the east, where the sky was beginning to brighten, hung a first-magnitude fuzzy "star" with a long, feathery tail. Comet Bennett had arrived, as advertised.

I grabbed Chris and pointed to the apparition in the east. Together, we hooted and hollered like kids as we gazed at our first ever full-grown comet. But time was short. We dressed warmly, then put my scope to work. More shouting! In addition to the gleaming nucleus and surrounding misty coma, we were amazed to see a crescent-shaped hood of dust and gas sweeping back into a gently curving, silk-smooth tail that extended well beyond the low-power field. I made a sketch, then stood in silence as Comet Bennett dissolved into the dawn.

Word spread quickly. Club members organized several Quiet Site comet watches, but clouds thwarted their efforts for nearly a week. Looking back at what Chris and I witnessed in the sky that momentous morning, I can hardly believe that our harebrained scheme actually worked. Comet Bennett was a classic unaided-eye comet—and we saw it first! ✦

Contributing editor Ken Hewitt-White and his RASC friends continued to observe Comet Bennett throughout April and May of 1970.

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